Allied Telesis

AT-TQ2403

Management Software

User's Guide

PN 613-001156 Rev. B

SAFETY NOTICE

- ✓ Do not open service or change any component.
- ✓ Only qualified technicians are allowed to service the equipment.
- ✓ Observe safety precautions to avoid electric shock
- ✓ Check voltage before connecting to the power supply.
  Connecting to the wrong voltage will damage the equipment.

LIMITATION OF LIABILITY AND DAMAGES

THE PRODUCT AND THE SOFTWARES WITHIN ARE PROVIDED "AS IS," BASIS. THE MANUFACTURER AND MANUFACTURER'S RESELLERS (COLLECTIVELY REFERRED TO AS "THE SELLERS") DISCLAIM ALL WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. IN NO EVENT WILL THE SELLERS BE LIABLE FOR DAMAGES OR LOSS, INCLUDING BUT NOT LIMITED TO DIRECT, INDIRECT, SPECIAL WILFUL, PUNITIVE, INCIDENTAL, EXEMPLARY, OR CONSEQUENTIAL, DAMAGES, DAMAGES FOR LOSS OF BUSINESS PROFITS, OR DAMAGES FOR LOSS OF BUSINESS OF ANY CUSTOMER OR ANY THIRD PARTY ARISING OUT OF THE USE OR THE INABILITY TO USE THE PRODUCT OR THE SOFTWARES, INCLUDING BUT NOT LIMITED TO THOSE RESULTING FROM DEFECTS IN THE PRODUCT OR SOFTWARE OR DOCUMENTATION, OR LOSS OR INACCURACY OF DATA OF ANY KIND, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY, EVEN IF THE PARTIES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE ENTIRE RISK AS TO THE RESULTS AND PERFORMANCE OF THE PRODUCT OR ITS SOFTWARE IS ASSUMED BY CUSTOMER. BECAUSE SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO THE PARTIES. IN NO EVENT WILL THE SELLERS' TOTAL CUMULATIVE LIABILITY OF EACH AND EVERY KIND IN RELATION TO THE PRODUCT OR ITS SOFTWARE EXCEED THE AMOUNT PAID BY CUSTOMER FOR THE PRODUCT.

ELECTRICAL SAFETY AND EMISSIONS STANDARDS

This product meets the following standards.

U.S. Federal Communications Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

For operation within 5.15 ~ 5.25GHz frequency range, it is restricted to indoor environment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Radiation Exposure Statement: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user.

Canadian Department of Communications

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Radiation Exposure Statement: This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Caution: The device for the band 5150-5250 MHz is only for indoor usage to reduce potential for harmful interference to co-channel mobile satellite systems.

High power radars are allocated as primary users (meaning they have priority) of 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage to LE-LAN devices.

This device has been designed to operate with an antenna having a maximum gain of 2.43 dB. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

CE Marking Warning

This device complies with the essential requirements of the R&TTE Directive 1999/5/EC. The following test methods have been applied in order to prove presumption of conformity with the essential requirements of the R&TTE Directive 1999/5/EC:

EN60950-1: 2006

Safety of Information Technology Equipment

EN 50385: 2002

Product standard to demonstrate the compliance of radio base stations and fixed terminal stations for wireless telecommunication systems with the basic restrictions or the reference levels related to human exposure to radio frequency electromagnetic fields (110MHz - 40 GHz) - General public

EN 300 328 V1.7.1 (2006-10)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

EN 301 893 V1.4.1: (2007-07)

Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive

EN 301 489-1 V1.8.1 (2008-04)

Electromagnetic compatibility and Radio Spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

EN 301 489-17 V1.3.2 (2008-04)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems , 5 GHz high performance RLAN equipment and 5,8GHz Broadband Data Transmitting Systems.

This device is a 2.4 GHz wideband transmission system (transceiver), intended for use in all EU member states and EFTA countries, except in France and Italy where restrictive use applies.

In Italy the end-user should apply for a license at the national spectrum authorities in order to obtain authorization to use the device for setting up outdoor radio links and/or for supplying public access to telecommunications and/or network services.

This device may not be used for setting up outdoor radio links in France and in some areas the RF output power may be limited to 10 mW EIRP in the frequency range of 2454 – 2483.5 MHz. For detailed information the end-user should contact the national spectrum authority in France.

CONTENTS

FIGURES

Preface

Purpose of This Guide

This guide is intended for customers and/or network administrators who are responsible for installing and maintaining the AT-TQ2403 Management Software.

How This Guide is Organized

This guide contains instructions on how to install AT-TQ2403 Management Software. This preface contains the following sections?

Chapter 1 Overview, describes the features, LEDs and ports on the equipment.

Chapter 2 Installation, describes how to install and configure the equipment.

Chapter 3 Troubleshooting, describes what you should do when the device does not operate correctly.

Document Conventions

This guide uses several conventions that you should become familiar with before you begin to install the product:

Note
A note provides additional information. Please go to the Allied Telesis website **http://www.alliedtelesis.com** for the translated safety statement in your language.

Warning
A warning indicates that performing or omitting a specific action may result in bodily injury.

Caution
A caution indicates that performing or omitting a specific action may result in equipment damage or loss of data.

Contacting Allied Telesis

This section provides Allied Telesis contact information for technical support as well as sales and corporate information.

Online Support

You can request technical support online by accessing the Allied Telesis Knowledge Base: **http://www.alliedtelesis.com/support/kb.aspx**. You can use the Knowledge Base to submit questions to our technical support staff and review answers to previously asked questions.

Email and Telephone Support

For Technical Support via email or telephone, refer to the Allied Telesis web site at **http://www.alliedtelesis.com**. Select your country from the list on the website and then select the appropriate tab.

Warranty

For product registration and warranty conditions please visit Allied Telesis website: **http://www.alliedtelesis.com/support/warranty/.**

Where to Find Web-based Guides

The installation and user guides for all Allied Telesis products are available for viewing in portable document format (PDF) from our website at **http://www.alliedtelesis.com**.

Returning Products

Products for return or repair must first be assigned a return materials authorization (RMA) number. A product sent to Allied Telesis without an RMA number will be returned to the sender at the sender's expense. For instructions on how to obtain an RMA number, go to the Support section on our website at **http://www.alliedtelesis.com**.

Sales or Corporate Information

You can contact Allied Telesis for sales or corporate information through our web site at **http://www.alliedtelesis.com**.

Management Software Updates

New releases of management software for our managed products are available from the following Internet sites:

- Allied Telesis web site: **http://www.alliedtelesis.com**
- Allied Telesis FTP server: **ftp://ftp.alliedtelesis.com**

If the FTP server prompts you to log on, enter "anonymous" as the user name and your email address as the password.

Tell Us What You Think

If you have any comments or suggestions on how we might improve this or other Allied Telesis documents, please contact us at **http://www.alliedtelesis.com**.

Chapter 1: Preparing to Set Up the AT-TQ2403 Wireless Access Point

Before you plug in and boot a new AT-TQ2403 Management Software, review the following sections for a quick check of required hardware components, software, client configurations, and compatibility issues. Make sure you have everything you need ready to go for a successful launch and test of your new (or extended) wireless network.

This chapter contains the following sections:

- Setting Up the Administrator's Computer
- Setting Up the Wireless Client Computers
- Understanding Dynamic and Static IP Addressing on the AT-TQ2403 Management Software

Setting Up the Administrator's Computer

You configure and administer AT-TQ2403 Management Software with the Kick Start utility (which you run from the CD) and through a web-based user interface (UI). In order to successfully start the management software, the administrator's computer must be set up with the following hardware and software components:

- **Ethernet connection**

  The computer used to configure the first AT-TQ2403 Management Software with Kick Start must be connected to the access point, either directly or through a hub, by an Ethernet cable.

- **Wireless Connection to the Network**

  After you initially configure and launch the first AT-TQ2403 Management Software, you can make further configuration changes through the management software using a wireless connection to the "internal" network. This configuration includes:

  ☞ Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point. (IEEE 802.11a, 802.11b, 802.11g, and 802.11a Turbo modes are supported.)

  ☞ Wireless client software such as Microsoft Windows XP or Funk Odyssey wireless client configured to associate with the AT-TQ2403 Management Software.

  For more details about the Wi-Fi client setup, see "Setting Up the Wireless Client Computers".

- **Web browser/operating system**

  Configuration and administration of the AT-TQ2403 Management Software is provided through a Web-based user interface hosted on the access point. Allied Telesis recommends using one of the following supported web browsers to access the AT-TQ2403 Management Software:

  ☞ Microsoft Internet Explorer version 5.5 or greater (with up-to-date patch level for either major version) on Microsoft Windows XP or Microsoft Windows 2000

  ☞ Netscape Mozilla 1.7.x on Redhat Linux version 2.4

The administration web browser must have JavaScript enabled to support the interactive features of the administration interface. It must also support HTTP uploads to use the firmware upgrade feature.

- **AT-TQ2403 Software and Documentation CD**

  This CD contains the Kick Start utility and the software documentation. You can run the Kick Start utility on Windows (only Windows 2000, XP, Vista, 2000 Server and 2003 Server) laptop or computer that is connected to the access point (via wired or wireless connection). It detects AT-TQ2403 Management Software on the network. The wizard steps you through initial configuration of new access points, and provides a link to the AT-TQ2403 Management Software where you finish the basic setup process in a step-by-step mode and launch the network.

  For more about using Kick Start, see "Running Kick Start to Find Access Points on the Network".

- **CD-ROM Drive**

  The administrator's computer must have a CD-ROM drive to run the Kick Start application on the AT-TQ2403 Software and Documentation CD.

- **Security Settings**

  Ensure that security is disabled on the wireless client used to initially configure the access point.

Setting Up the Wireless Client Computers

The AT-TQ2403 Management Software provides wireless access to any client with a properly configured Wi-Fi client adapter for the 802.11 mode in which the access point is running.

Multiple client operating systems are supported. Clients can be laptops or desktops, personal digital assistants (PDAs), or any other hand-held, portable or stationary device equipped with a Wi-Fi adapter and supporting drivers.

In order to connect to the access point, wireless clients need the following software and hardware:

- **Wi-Fi Client Adapter**

  Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point. (IEEE 802.11a, 802.11b, 802.11g, and 802.11a Turbo modes are supported.)

  Wi-Fi client adapters vary considerably. The adapter can be a PC card built in to the client device, a portable PCMCIA or PCI card (types of NICs), or an external device such as a USB or Ethernet adapter that you connect to the client by means of a cable.

  The AT-TQ2403 Wireless Access Point supports 802.11a/g modes. The fundamental requirement for clients is that they all have configured adapters that match the 802.11 a/g mode.

- **Wireless Client Software**

  Client software such as Microsoft Windows Supplicant or Funk Odyssey wireless client configured to associate with the AT-TQ2403 Management Software.

- **Client Security Settings**

  Security should be disabled on the client used to do initial configuration of the access point.

  If the Security mode on the access point is set to anything other than plain-text, wireless clients will need to set a profile to the authentication mode used by the access point and provide a valid

username and password, certificate, or similar user identity proof. Security modes are Static WEP, IEEE 802.1x, WPA with RADIUS server, and WPA-PSK.

For information on configuring security on the access point, see "Configuring Security".

Understanding Dynamic and Static IP Addressing on the AT-TQ2403 Management Software

AT-TQ2403 Management Software are designed to auto-configure, with very little setup required for the first access point and no configuration required for additional access points subsequently joining a pre-configured cluster.

How Does the Access Point Obtain an IP Address at Start-up?

When you deploy the access point, it looks for a network DHCP server and, if it finds one, obtains an IP address from the DHCP server. If no DHCP server is found on the network, the access point will continue to use its default static IP address (192.168.1.230) until you reassign it a new static IP address (and specify a static IP addressing policy) or until a DHCP server is brought online.

When you run Kick Start, it discovers the AT-TQ2403 Management Software on the network and lists their IP addresses and MAC addresses. Kick Start also provides a link to the administration web pages of each access point using the IP address in the URL. (For more information about the Kick Start utility, see "Running Kick Start to Find Access Points on the Network".)

Dynamic IP Addressing

The AT-TQ2403 Management Software generally expects that a DHCP server is running on the network where the access point is deployed. Most home and small business networks already have DHCP service provided either via a gateway device or a centralized server. However, if no DHCP server is present on the internal network, the access point will use the default static IP address for first time startup.

Similarly, wireless clients and other network devices (such as printers) will receive their IP addresses from the DHCP server, if there is one. If no DHCP server is present on the network, you must manually assign static IP addresses to your wireless clients and other network devices.

The Guest network must have a DHCP sever.

Static IP Addressing

The AT-TQ2403 Management Software is shipped with a default static IP address of 192.168.1.230. If no DHCP server is found on the network, the access point retains this static IP address at first-time startup.

After the access point starts up, you have the option of specifying a static IP addressing policy on AT-TQ2403 Management Software and assigning static IP addresses to access points on the internal network using the management software. (See information about the Connection Type field and related fields in "Setting the Ethernet (Wired) Interface".)

Caution: If you do not have a DHCP server on the internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the Connection Type from DHCP to Static IP. You can either assign a new Static IP address to the access point or continue using the default address. Allied Telesis recommends assigning a new Static IP address so that if later you bring up another AT-TQ2403 Management Software on the same network, the IP address for each access point will be unique.

Recovering an IP Address

If you experience trouble communicating with the access point, you can recover a static IP address by resetting the access point configuration to the factory defaults (see "Backing up and Restoring a Configuration"), or you can get a dynamically assigned address by connecting the access point to a network that has DHCP.

Chapter 2: Setting up the AT-TQ2403 Management Software

Setting up and deploying one or more AT-TQ2403 Management Software is in effect creating and launching a wireless network. The Kick Start utility and corresponding AT-TQ2403 Management Software Basic Settings web page simplify this process. This chapter contains procedures for setting up your AT-TQ2403 Management Software and the resulting wireless network.

This chapter includes the following procedures:

- Running Kick Start to Find Access Points on the Network
- Logging in to the AT-TQ2403 Management Software
- Configuring the Basic Settings and Starting the Wireless Network

Running Kick Start to Find Access Points on the Network

Kick Start is an easy-to-use utility for discovering and identifying new AT-TQ2403 Management Software. Kick Start scans the network looking for access points, displays ID details on those it finds, and provides access to the AT-TQ2403 Management Software.

Note: Kick Start recognizes and configures only AT-TQ2403 Management Software. Kick Start will not find or configure non AT-TQ2403 Management Software and will not find any other devices.

Note: Run Kick Start only in the subnet of the internal network.

Note: Kick Start finds only those access points that have IP addresses. IP addresses are dynamically assigned to access points if you have a DHCP server running on the network. If you deploy the access point on a network with no DHCP server, the default static IP address (192.168.1.230) is used.

Caution: Use caution with non-DHCP enabled networks: Do not deploy more than one new access point on a non-DHCP network because they will use the same default static IP addresses and conflict with each other. (For more information, see "Setting the Ethernet (Wired) Interface" and "How Does the Access Point Obtain an IP Address at Start-up?".)

To start the discovery process, perform the following procedure:

1. Do one of the following to create an Ethernet connection between the access point and your computer:

   ☞ Connect one end of an Ethernet cable to the LAN port on the access point and the other end to the same hub where your PC is connected.

   Or

   ☞ Connect one end of an Ethernet cable to the LAN port on the access point and the other end of the cable to the Ethernet port on your PC.

2. Insert the AT-TQ2403 Wireless Access Point CD into the CD-ROM drive on your computer.

The Kick Start Welcome dialog box is displayed, as shown in Figure 1

Figure 1: Kick Start Welcome Dialog Box

3. Click **Next** to search for access points

Wait for the search to complete, or until Kick Start has found your new access points, as shown in Figure 2.

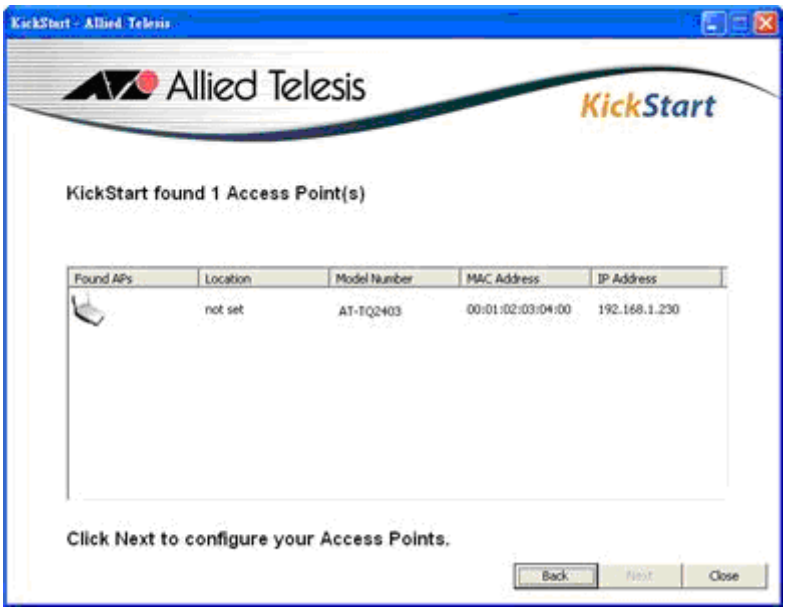


Figure 2: Kick Start Search Results Dialog Box

Note: If no access points are found, Kick Start indicates this and presents some troubleshooting information about your LAN and power connections. After you check the hardware power and Ethernet connections, you can click **Back** to search again for access points.

4. Review the list of access points found

   Kick Start detects the IP addresses of AT-TQ2403 Management Software. Access points are listed with their locations, media access control (MAC) addresses, and IP addresses, as shown in Figure 2. If you are installing the first access point on a single-access-point network, only one entry is displayed on this screen.

5. Verify the MAC addresses against the hardware labels for each access point. This will be especially helpful later in providing or modifying the descriptive Location name for each access point.

6. Click **Next**

   The Administration dialog box opens, as shown in Figure 3.

Figure 3: Administration Dialog Box

Note: Kick Start provides a link to the AT-TQ2403 Management Software web pages via the IP address of the first access point of each model. (For more information about model types and clustering see "What Kinds of APs Can Cluster Together?".)

The AT-TQ2403 Management Software is a centralized management tool that you can access through the IP address for any access point in a cluster.

After your other access points are configured, you can also link to the AT-TQ2403 Management Software web pages using the IP address for any of the other AT-TQ2403 Management Software, for example **http://IPAddressOfAccessPoint.**

Logging in to the AT-TQ2403 Management Software

To access the AT-TQ2403 Management Software, perform the following procedure:

7. In the Kick Start Administration dialog box, click **Administration**

   You are prompted for a user name and password, as shown in Figure 4.

   Username: **manager**

Password: **friend**

Figure 4: Log-in Dialog Box

Note: The user name can not be modified.

8. Enter the username and password and click **OK**

When you log in for the first time, the Basic Settings page is displayed, as shown in Figure 5. This page displays the global settings for all access points that are members of the cluster and, if you specify automatic configuration, for any new access points that you add later.

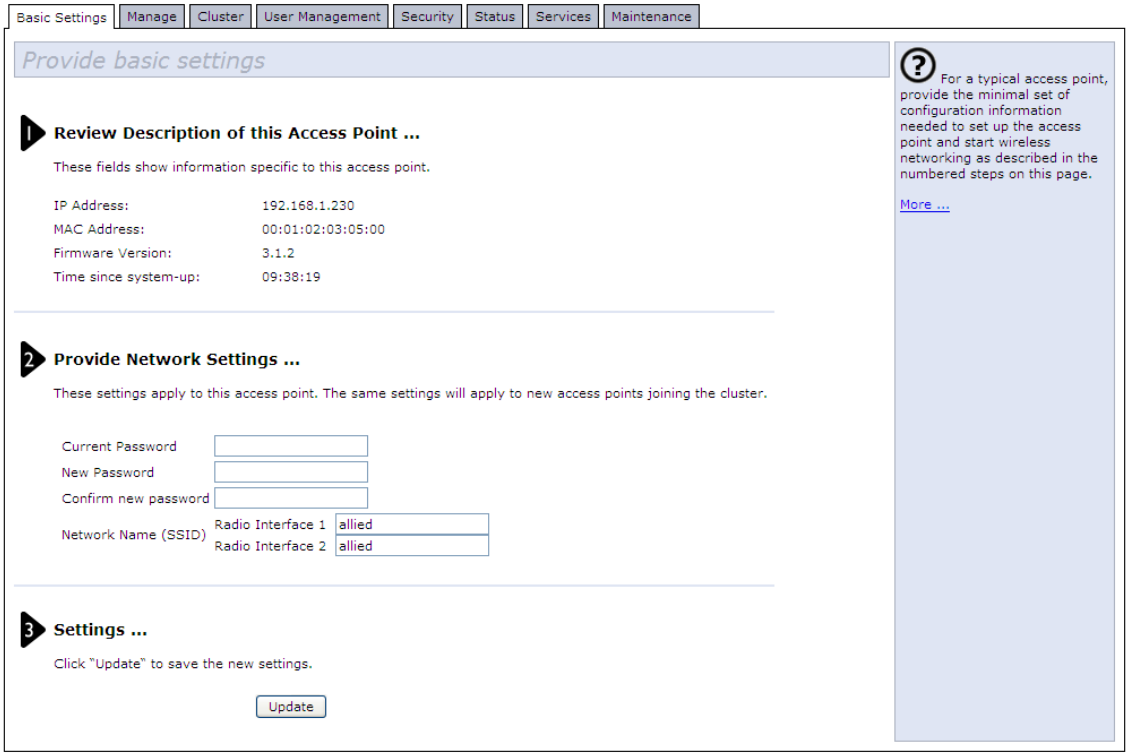


Figure 5: Basic Settings Page

Configuring the Basic Settings and Starting the Wireless Network

Provide a minimal set of configuration information by defining the basic settings for your wireless network. These settings are all available on the Basic Settings page in the AT-TQ2403 Management Software, and are categorized into steps 1-3 on the web page.

Configuring the Basic Settings

9. To configure initial settings, perform the following procedure:

In the "Review Description of this Access Point" section, configure the following parameters as necessary:

IP Address

The IP address assigned to this access point. You cannot edit this field because the IP address is already assigned (either through DHCP or statically through the Ethernet (wired)) settings as described in "Configuring LAN or Internal Interface Ethernet Settings".

MAC Address

Shows the MAC address of the access point.

A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface.

The address shown here is the MAC address for the bridge (br0). This is the address by which the access point is known externally to other networks.

Firmware Version

Version information about the firmware currently installed on the access point.

As new versions of the AT-TQ2403 Management Software firmware become available, you can upgrade the firmware on your access points to take advantages of new features and enhancements.

For instructions on how to upgrade the firmware, see "Upgrading the Firmware".

Time since system-up

It is to show the passed time since system boot up.

10. In the "Provide Network Settings" section, configure the following parameters as necessary:

Current Password

As an immediate first step in securing your wireless network, Allied Telesis recommends that you change the administrator password from the default which is "friend." Enter the current administrator password.

The administrator password must be an alphanumeric string of up to 8 characters. Do not use special characters or spaces.

New Password

Enter a new administrator password. The characters you enter are displayed as " * " characters to

prevent others from seeing your password as you type.

Confirm New Password

Retype the new administrator password to confirm that you typed it as you intended.

Network Name (SSID)

Enter a name for the wireless network as a character string. This name will apply to all access points on this network. As you add more access points, they will share this SSID.

The Service Set Identifier (SSID) is an alphanumeric string of up to 32 characters.

If you are connected as a wireless client to the same access point that you are administering, resetting the SSID will causes you to lose connectivity to the access point. You will need to reconnect to the new SSID after you save the new Network Name.

Note: The AT-TQ2403 Management Software is not designed for multiple, simultaneous configuration changes. If you have a network that includes multiple access points, and more than one administrator is logged on to the AT-TQ2403 Management Software's web pages and making changes to the configuration, all access points in the cluster will stay in sync but there is no guarantee that all configuration changes specified by multiple users will be applied.

11. In the Settings section, click **Update** to apply these settings and deploy the access point as a wireless network.

    After you have the wireless network up and running and have tested against the access point with some wireless clients, you can add in more layers of security, add users, configure a guest interface, and fine-tune performance settings. These features are described in the rest of this guide.

Chapter 3: Configuring Basic Settings

The basic configuration tasks are described in the following sections:

- Navigating to Basic Settings
- Review / Describe the Access Point
- Provide Network Settings
- Update Basic Settings
- Basic Settings for a Standalone Access Point
- Setting User Interface Scheme Preferences
- Navigation

Navigating to Basic Settings

To configure initial settings, click **Basic Settings**.

If you type the IP address of the access point into you browser, the Basic Settings page is the default page that is displayed.

Fill in the fields on the Basic Settings screen as described below.

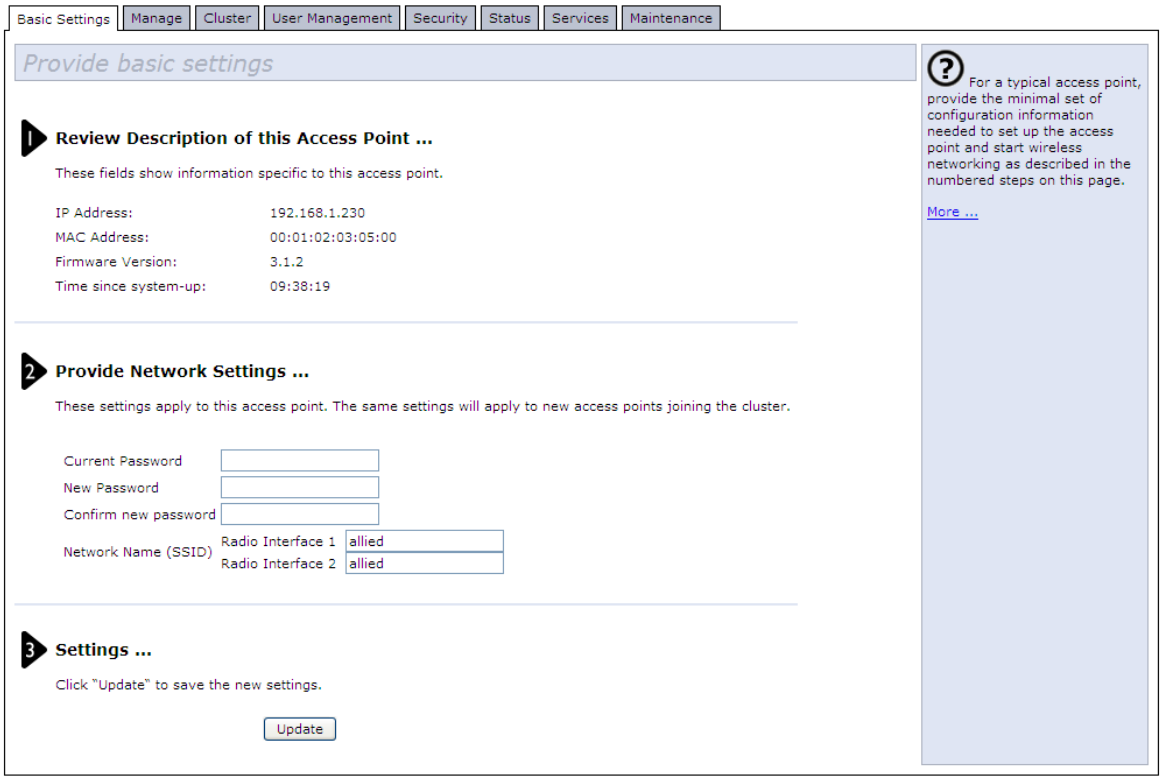


Figure 6: Basic Settings Page

Review / Describe the Access Point

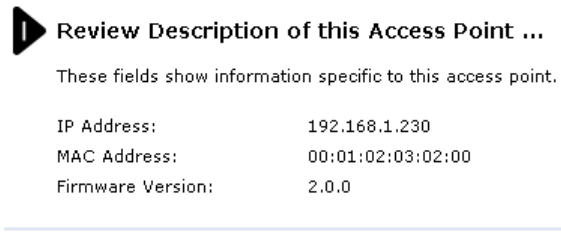


Figure 7: Basic Settings Page Step 1

Field	Description
IP Address	Shows IP address assigned to this access point. This field is not editable because the IP address is already assigned (either via DHCP, or statically through the Ethernet Settings page as described in "Configuring Guest Interface Ethernet (Wired) Settings").
MAC Address	Shows the MAC address of the access point. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface. The address shown here is the MAC address for the bridge (br0). This is the address by which the AP is known externally to other networks. To see MAC addresses for Guest and Internal interfaces on the AP, see the **Status > Interfaces** tab.
Firmware Version	Version information about the firmware currently installed on the access point. As new versions of the AT-TQ2403 Management Software firmware become available, you can upgrade the firmware on your access points to take advantages of new features and enhancements. For instructions on how to upgrade the firmware, see "Upgrading the Firmware".
Time since system-up	It is to show the passed time since system boot up.

Provide Network Settings

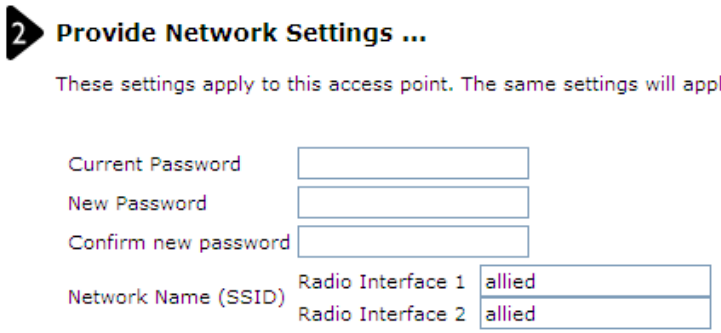


Figure 8: Basic Settings Step 2

Field	Description
Current Password	Enter the current administrator password. You must correctly enter the current password before you are able to change it.
New Password	Enter a new administrator password. The characters you enter will be displayed as " * " characters to prevent others from seeing your password as you type. The Administrator password must be a string of up to 8 characters. Please do not include space (' ') and any of the characters within the parenthesis: ("$:<>'&*). The characters you input are case-sensitive. **Note:** As an immediate first step in securing your wireless network, we recommend that you change the administrator password from the default.
Confirm New Password	Re-enter the new administrator password to confirm that you typed it as intended.
Network Name (SSID)	Enter a name for the wireless network as a character string. This name will apply to all access points on this network. As you add more access points, they will share this SSID. The Service Set Identifier (SSID) is a string of up to 32 characters. The characters you input are case-sensitive. **Note:** If you are connected as a wireless client to the same AP that you are administering, resetting the SSID will cause you to lose connectivity to the AP. You will need to reconnect to the new SSID after you save this new setting.

Note: The AT-TQ2403 Management Software is not designed for multiple, simultaneous configuration changes. If you have a network that includes multiple access points, and more than one administrator is logged on to the Administration Web pages and making changes to the configuration, all access points in the cluster will stay in sync but there is no guarantee that all configuration changes specified by multiple users will be applied.

Update Basic Settings

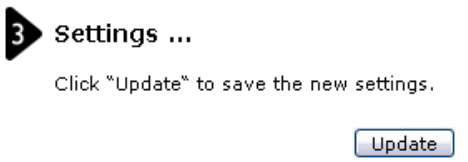


Figure 9: Basic Settings Page Step 3

When you have reviewed the new configuration, click **Update** to apply the settings and deploy the access points as a wireless network.

Basic Settings for a Standalone Access Point

The Basic Settings tab for a standalone access point indicates only that the current mode is standalone. If you want to add the current access point to an existing cluster, navigate to the **Cluster > Access Point** tab.

For more information see "Starting Clustering".

Setting User Interface Scheme Preferences

Figure 10: Web User Interface Setting

A design panel appears at the top of every AP Configuration screen enabling you to configure the appearance of every web page. You can change the layout of tabs on pages by choosing between three navigation settings.

Navigation

You use the options available in the navigation drop down list to change the layout of the tab options on your screen.

Option	Description
Horizontal Tabs	Select this option to display all tabs horizontally across the top of the page.
Vertical Tabs	Select this option to display all tabs vertically on the left side of your page.
Drop Down Menu	Select this option to display all tabs horizontally across the top of the page. Any sub categories will be displayed as a drop down menu beneath the main tab.

Chapter 4: Managing Access Points and Clusters

The AT-TQ2403 Management Software shows current basic configuration settings for clustered access points (location, IP address, MAC address, status, and availability) and provides a way of navigating to the full configuration for specific APs if they are cluster members.

Standalone access points or those which are not members of this cluster do not show up in this listing. To configure standalone access points, you must discover or know the IP address of the access point and by using its IP address in a URL (**http://IPAddressOfAccessPoint**).

Note: The AT-TQ2403 Management Software is not designed for multiple, simultaneous configuration changes. If you have a network that includes multiple access points, and more than one administrator is logged on to the Administration Web pages and making changes to the configuration, all access points in the cluster will stay in sync but there is no guarantee that all configuration changes specified by multiple users will be applied.

The following topics are covered:

- Navigating to Access Points Management
- Understanding Clustering
    - What is a Cluster?
    - How Many APs Can a Cluster Support?
    - Only the same country domain setting can be clustered.
    - What Kinds of APs Can Cluster Together?
    - Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?
    - Cluster Formation
    - Cluster Size and Membership
    - Intra-Cluster Security
- Understanding Access Point Settings
- Modifying the Location Description
- Setting the Cluster Name
- Stopping Clustering
- Starting Clustering
- Navigating to Configuration Information for a Specific AP and Managing Standalone APs
- Navigating to an AP by Using its IP Address in a URL

Navigating to Access Points Management

To view or edit information on access points in a cluster, click the **Cluster > Access Points** tab.

Figure 11: Access Points Setting Page

Understanding Clustering

A key feature of the AT-TQ2403 Management Software is the ability to form a dynamic, configuration-aware group (called a cluster) with other AT-TQ2403 Management Software in a network in the same subnet. Access points can participate in a self-organizing cluster which makes it easier for you to deploy, administer, and secure your wireless network. The cluster provides a single point of administration and lets you view the deployment of access points as a single wireless network rather than a series of separate wireless devices.

What is a Cluster?

A cluster is a group of access points which are coordinated as a single group via AP administration. You can have multiple clusters on the same subnet if they have different cluster "names".

How Many APs Can a Cluster Support?

Validation testing has verified 15 AP without enable Virtual Wireless Network function on the same subnet. Validation testing has verified 8 AP with enable 4 Virtual Wireless Network on the same subnet. In this test case the cluster function works well.

Only the same country domain setting can be clustered.

Note: If the devices are assigned with different country setting, they can not be clustered together.

What Kinds of APs Can Cluster Together?

A single AT-TQ2403 Wireless Access Point can form a cluster with itself (a "cluster of one") and with other AT-TQ2403 Wireless Access Points of the same model. In order to be members of the same cluster, access points must be:

- Of the same Country Domain configuration
- Compatible devices as designated by the manufacturer (APs must have compatible design features)
- Of the same F/W Version
- Of the same LAN
- On the same Cluster Name

However, it is helpful to understand the clustering behavior for administration purposes:

- Access points joining the cluster must be named the same. For more information on setting the cluster name, see "Setting the Cluster Name".
- Access points of other brands will not join the cluster. These APs should be administered with their own associated Administration tools.

Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?

Most configuration settings defined via the AT-TQ2403 Management Software Administration Web pages will be propagated to cluster members as a part of the cluster configuration.

Settings Shared in the Cluster Configuration

The cluster configuration includes:

- Network name (SSID)
- Administrator password
- User accounts and authentication
- Wireless interface settings
- Guest Welcome screen settings
- Network Time Protocol (NTP) settings
- QoS queue (AP EDCA parameters only)
- Radio settings

Only Mode, Channel, Fragmentation Threshold, RTS Threshold and Rate Sets are synchronized across the cluster. Beacon Interval, DTIM Period, Maximum Stations, and Transmit Power do not cluster.

Note: When Channel Planning is enabled, the radio Channel is not synced across the cluster. See "Stopping/Starting Automatic Channel Assignment".

When Channel Planning is enabled, the radio Channel is not synced across the cluster.

- Security settings
- MAC address filtering

Settings Not Shared by the Cluster

The few exceptions (settings not shared among clustered access points) are the following, most of which by nature must be unique:

- IP addresses
- MAC addresses
- Location descriptions
- Load Balancing settings
- WDS bridges
- Ethernet (Wired) Settings, including enabling or disabling Guest access
- Guest interface configuration

Settings that are not shared must be configured individually on the Administration pages for each access point. To get to the Administration pages for an access point that is a member of the current cluster, click on its IP Address link on the **Cluster > Access Points** page of the current AP.

Cluster Formation

A cluster is formed when the first AP is deployed with clustering enabled. The AP attempts to rendezvous with an existing cluster.

If it is unable to locate any other APs on the subnet with the same cluster name, then it establishes a new cluster on its own.

When AT-TQ2403 enables cluster function, it sends out its configuration file to all the devices in the clustered group.

If there is more than one AT-TQ2403 in the clustered group, the last-joined AT-TQ2403 shares its configuration with other AT-TQ2403 in the group.

Cluster Size and Membership

Validation testing has verified 15 AP without enable VWN function on the same subnet. Validation testing has verified 8 AP with enable 4 VWN on the same subnet. In this test case the cluster function works well. Cluster membership is determined by:

- Cluster Name - APs with the same name will join the same cluster. (see "Setting the Cluster Name")
- Whether clustering is enabled - Only APs for which clustering is enabled will join a cluster. (see "Starting Clustering" and "Stopping Clustering")

Intra-Cluster Security

For purposes of ease-of-use, the clustering component is designed to let new devices join a cluster without strong authentication. However, communications of all data between access points in a cluster is protected against casual eavesdropping using Secure Sockets Layer (typically referred to as SSL). The assumption is that the private wired network to which the devices are connected is secure. Both the cluster configuration file and the user database are transmitted among access points using SSL.

Understanding Access Point Settings

The **Access Points** tab provides information about all access points in the cluster.

From this page, you can view location descriptions, MAC addresses, IP addresses, enable (activate) or disable (deactivate) clustered access points, and remove access points from the cluster. You can also modify the location description for an access point.

The IP address links provide a way to navigate to configuration settings and data on an access point. Stand-alone access points (those which are not members of the cluster) are not shown on this page.

Figure 12: Access Points Setting Page

The following table describes the access point settings and information display in detail.

Field	Description
Location	Description of where the access point is physically located.

Field	Description
Mac Address	Media Access Control (MAC) address of the access point. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for the access point. The address shown here is the MAC address for the bridge (br0). This is the address by which the AP is known externally to other networks. To see MAC addresses for Guest and Internal interfaces on the AP, see the **Status > Interfaces** tab.
IP Address	Specifies the IP address for the access point. Each IP address is a link to the AT-TQ2403 Management Software web pages for that access point. You can use the links to navigate to the Administration Web pages for a specific access point. This is useful for viewing data on a specific access point to make sure a cluster member is picking up cluster configuration changes, to configure advanced settings on a particular access point, or to switch a standalone access point to cluster mode.

Modifying the Location Description

To make modifications to the location description:

1. Navigate to the **Cluster > Access Points** tab.
2. Under the **Clustering Options** section, type the new location of the AP in the **Location** field.
3. This text max length limit is 128.
4. Click the **Update** button to apply the changes.

Setting the Cluster Name

To set the name of the cluster you want your AP to join, do the following:

1. Navigate to the **Cluster > Access Points** tab.
2. Under the **Clustering Options** section, type the new cluster name in the **Cluster Name** field.
3. The Cluster name is up to 128 characters long.
4. Click the **Update** button to apply the changes.

Note: If you want multiple APs to join a particular cluster, all these APs should have the same Cluster Name specified in the Cluster Name field. If the cluster name is different the AP will not be able to join the cluster.

Stopping Clustering

To stop clustering and remove a particular access point from a cluster, do the following.

1. Go to the **Administration** Web pages for the access point you want to remove from the cluster.
2. Click the **Cluster > Access Points** tab.
3. Click the **Stop Clustering** button to remove the access point from the Cluster.

The change will be reflected under Status for that access point; the access point will now show as standalone (instead of cluster).

Note: In some situations it is possible for the cluster to become out of sync. If after removing an access point from the cluster, the AP list still reflects the deleted AP or shows an incomplete display; refresh your browser. If you still experience problems, refer to the information on Cluster Recovery in "Appendix B: Troubleshooting".

Starting Clustering

To start clustering and add a particular access point to a cluster, do the following.

1. Go to the Administration Web pages for the standalone access point. (See "Navigating to an AP by Using its IP Address in a URL".)

   The Administration Web pages for the standalone access point are displayed.
2. Click the **Cluster > Access Points** tab for the standalone access point.
3. Click the **Start Clustering** button.

The access point is now a cluster member. It appears in the list of clustered access points on the **Cluster > Access Points** tab page.

Note: In some situations it is possible for the cluster to become out of sync. If after removing an access point from the cluster, the AP list still reflects the deleted AP or shows an incomplete display; refer to the information on Cluster Recovery in "Appendix B: Troubleshooting".

Navigating to Configuration Information for a Specific AP and Managing Standalone APs

In general, the AT-TQ2403 Management Software is designed for central management of clustered access points. For access points in a cluster, all access points in the cluster reflect the same configuration. In this case, it does not matter which access point you actually connect to for administration.

There may be situations, however, when you want to view or manage information on a particular access point. For example, you might want to check status information such as client associations or events for an access point. Or you might want to configure and manage features on an access point that is running in standalone mode. In these cases, you can navigate to the AT-TQ2403 Management Software web interface for individual access points by clicking the IP address links on the Access Points page.

All clustered access points are shown on the **Cluster > Access Points** page. To navigate to clustered access points, you can simply click on the IP address for a specific cluster member shown in the list.

Navigating to an AP by Using its IP Address in a URL

You can also link to the **Administration** Web pages of a specific access point, by entering the IP address for that access point as a URL directly into a Web browser address bar in the following form:

http://IPAddressOfAccessPoint

Where *IPAddressOfAccessPoint* is the address of the particular access point you want to monitor or configure.

For standalone access points, this is the only way to navigate to their configuration information.

If you do not know the IP address of a standalone access point, use Kick Start to find all access points on the network and you should be able to derive which ones are standalone by comparing Kick Start findings with access points listed on the **Cluster > Access Points** page. The Access points that Kick Start finds that are not shown on this page are probably standalone access points.

Chapter 5: Managing User Accounts

The AT-TQ2403 Management Software includes user management capabilities for controlling client access to access points.

User management and authentication must always be used in conjunction with the following two security modes, which require use of a RADIUS server for user authentication and management.

- IEEE 802.1x mode (see "IEEE 802.1x" in Configuring Security)
- WPA with RADIUS mode (see "WPA Enterprise" in Configuring Security)

You have the option of using either the internal RADIUS server embedded in the AT-TQ2403 Management Software or an external RADIUS server that you provide. If you use the embedded RADIUS server, use this Administration Web page on the access point to set up and manage user accounts. If you are using an external RADIUS server, you will need to set up and manage user accounts on the Administrative interface for that server.

On the **User Management** page, you can create, edit, remove, and view client user accounts. Each user account consists of a user name and password. The set of users specified here represent approved clients that can log in and use one or more access points to access local and possibly external networks via your wireless network.

Note: Users specified here are clients of the access point(s) who use the APs as a connectivity hub, not administrators of the wireless network. Only those with the administrator username and password and knowledge of the administration URL can log in as an administrator and view or modify configuration settings.

The following topics are covered:

- Navigating to User Management for Clustered Access Points
- Viewing User Accounts
- Adding a User
- Editing a User Account
- Enabling and Disabling User Accounts
- Removing a User Account
- Backing Up and Restoring a User Database

Navigating to User Management for Clustered Access Points

To set up or modify user accounts, click the **User Management** tab.

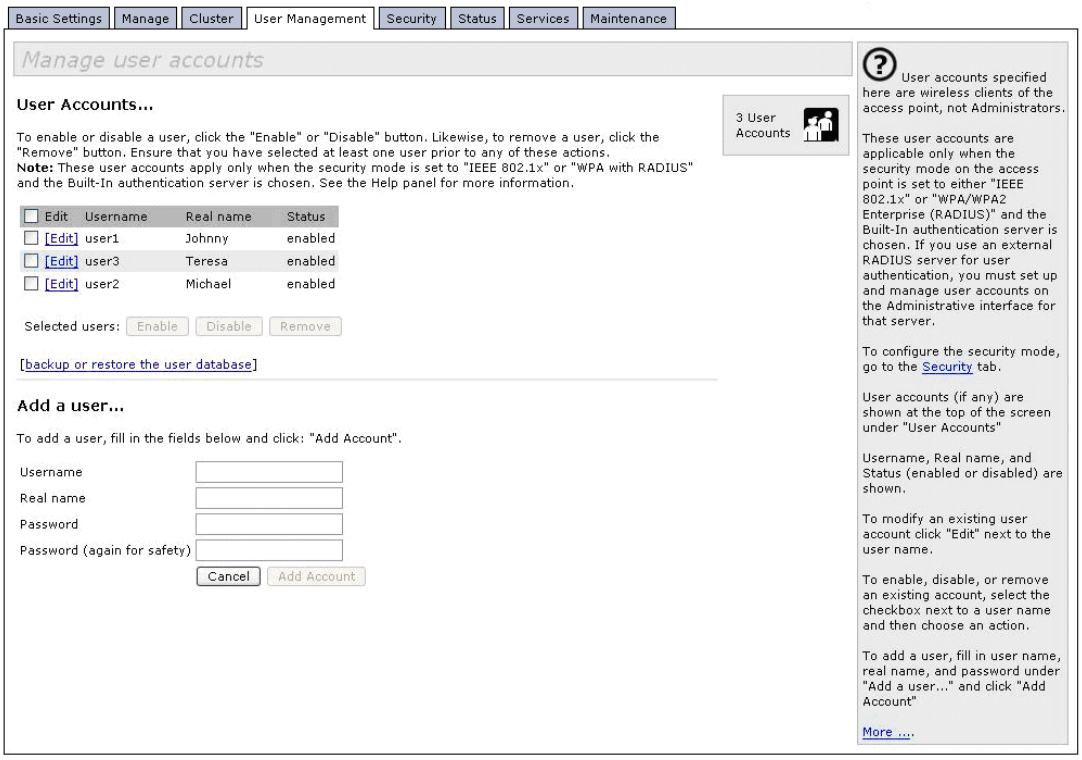


Figure 13: User Management Page

Viewing User Accounts

User accounts are shown at the top of the screen under "User Accounts". The Username, Real name and Status (enabled or disabled) of the user are shown. You make modifications to an existing user account by first selecting the checkbox next to a user name and then choosing an action. (See "Editing a User Account".)

Adding a User

To create a new user, do the following:

1. Under "Add a User", provide information in the following fields.

Field	Description
Username	Provide a user name. Usernames are strings of with 3~237 characters. Please do not include any of the characters within the parenthesis: ("<>'&).
Real Name	For information purposes, provide the user's full name. Real name is a string of up to 256 characters. Please do not include any of the characters within the parenthesis: ("<>'&). If you do not specify this field, the Username will be saved as Real name.

Field	Description
Password	Specify a password for this user. Passwords are strings of 4 to 256 characters. Please do not include '<' and '&'.

2. When you have filled in the fields, click **Add Account** to add the account.

   The new user is then displayed in "User Accounts". The user account is enabled by default when you first create it.

Note: A limit of 100 user accounts per access point is imposed by the Administration user interface. Network usage may impose a more practical limit, depending upon the demand from each user.

Editing a User Account

Once you have created a user account, it is displayed under "User Accounts" at the top of the **User Management** Administration Web page. To make modifications to an existing user account, first click the checkbox next to the username so that the box is checked.

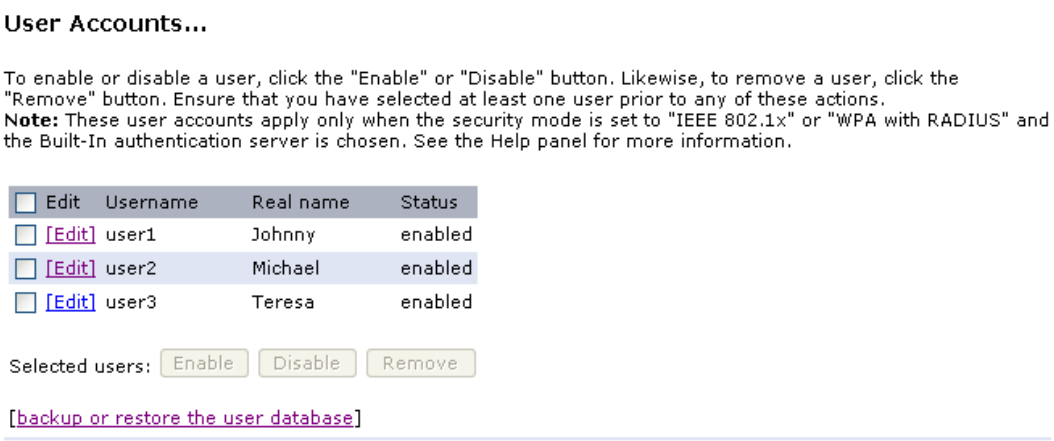


Figure 14: Cluster Settings Page Detail

Then, choose an action such as **Edit**, **Enable**, **Disable**, or **Remove**.

Enabling and Disabling User Accounts

A user account must be enabled for the user to log on as a client and use the access point.

You can enable or disable any user account. With this feature, you can maintain a set of user accounts and authorize or prevent users from accessing the network without having to remove or re-create accounts. This can come in handy in situations where users have an occasional need to access the network. For example, contractors who do work for your company on an intermittent but regular basis might need network access for 3 months at a time, then be off for 3 months, and back on for another assignment. You can enable and disable these user accounts as needed, and control access as appropriate.

Enabling a User Account

To enable a user account, click the checkbox next to the username and click **Enable**.

A user with an account that is *enabled* can log on to the wireless access points in your network as a client.

Disabling a User Account

To disable a user account, click the checkbox next to the username and click **Disable**.

A user with an account that is disabled cannot log on to the wireless access points in your network as a client. However, the user remains in the database and can be enabled later as needed.

Removing a User Account

To remove a user account, click the checkbox next to the username and click **Remove**.

If you think you might want to add this user back in at a later date, you might consider disabling the user rather than removing the account altogether.

Backing Up and Restoring a User Database

You can save a copy of the current set of user accounts to a backup configuration file. The backup file can be used at a later date to restore the user accounts on the AP to the previously saved configuration.

Backing Up the User Database

To create a backup copy of the user accounts for this access point:

1. Click the **backup or restore the user database** link.

   A File Download or Open dialog is displayed.

2. Choose the **Save** option on this first dialog.

   This brings up a file browser.

3. Use the file browser to navigate to the directory where you want to save the file, and click **OK** to save the file.

   You can keep the default file name (wirelessUsers.ubk) or rename the backup file, but be sure to save the file with a .ubk extension.

Restoring a User Database from a Backup File

To restore a user database from a backup file:

1. Select the backup configuration file you want to use, either by typing the full path and file name in the Restore field or click **Browse** and select the file.

   (Only those files that were created with the User Database Backup function and saved as .ubk backup configuration files are valid to use with Restore; for example, wirelessUsers.ubk.)

2. Click the **Restore** button.

   When the backup restore process is complete, a message is shown to indicate that the user database has been successfully restored. (This process is not time-consuming; the restore should complete almost immediately.)

3. Click the **User Management** tab to see the restored user accounts.

Chapter 6: Session Monitoring

The AT-TQ2403 Management Software provides real-time session monitoring information including which clients are associated with a particular access point, data rates, transmit/receive statistics, signal strength, and idle time. The following Session Monitoring topics are covered here:

- Navigating to Session Monitoring
- Understanding Session Monitoring Information
- Sorting Session Information
- Refreshing Session Information

Navigating to Session Monitoring

To view session monitoring information, click the **Cluster > Sessions** tab.

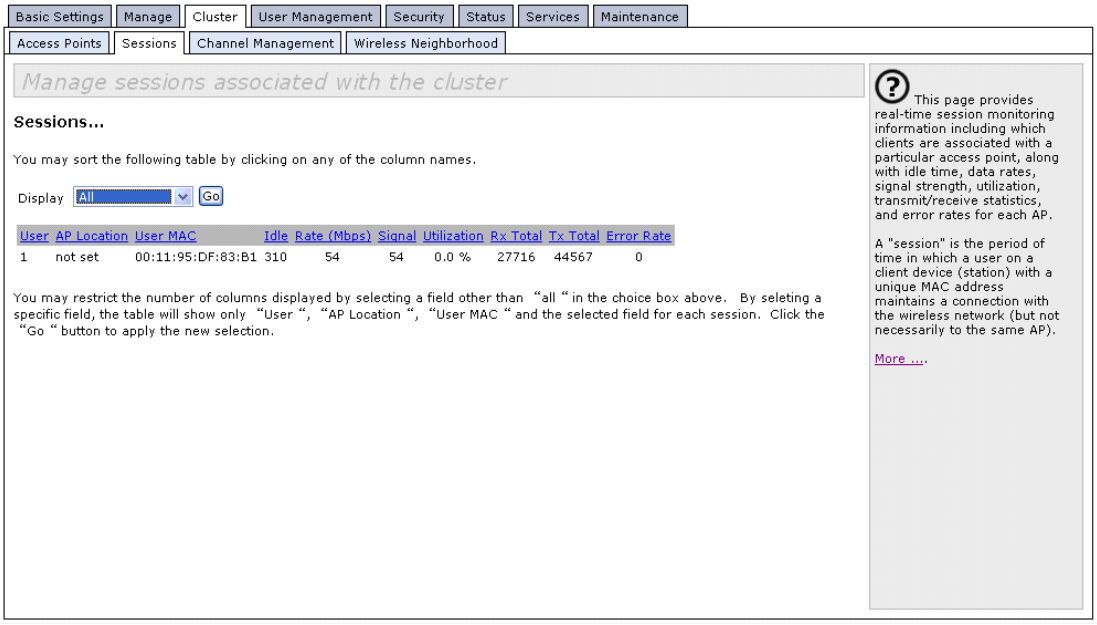


Figure 15: Sessions Setting Page

Understanding Session Monitoring Information

The Sessions page shows information on client stations associated with access points in the cluster. Each client is identified by user name and user MAC address, along with the AP (location) to which it is currently connected.

To view a particular statistic for client sessions, select an item from the Display drop-down list and click **Go**. You can view information on Idle Time, Data Rate, Signal, Utilization, and so on; all of which are described in detail in the table below.

A "session" in this context is the period of time in which a user on a client device (station) with a unique

MAC address maintains a connection with the wireless network. The session begins when the client logs on to the network, and the session ends when the client either logs off intentionally or loses the connection for some other reason.

Note: A *session* is not the same as an *association*, which describes a client connection to a particular access point. A client network connection can shift from one clustered AP to another within the context of the same session. A client station can roam between APs and maintain the session.

Details about the session information shown is described below.

Field	Description
User	Indicates the client user name of IEEE 802.1x clients. **Note:** This field is relevant only for clients that are connected to APs using IEEE 802.1x security mode and local authentication server. (For more information about this mode, see "IEEE 802.1x".) For clients of APs using IEEE 802.1x with RADIUS server or other security modes, no user name will be shown here.
AP Location	Indicates the location of the access point. This is derived from the location description specified on the **Basic Settings** tab.
User Mac	Indicates the MAC address of the user's client device (station). A MAC address is a hardware address that uniquely identifies each node of a network.
Idle	Indicates the amount of time this station has remained inactive. A station is considered to be "idle" when it is not receiving or transmitting data.
Rate (Mbps)	The speed at which this access point is transferring data to the specified client. The data transmission rate is measured in megabits per second (Mbps). This value should fall within the range of the advertised rate set for the IEEE 802.1x mode in use on the access point. For example, 6 to 54Mbps for 802.11a.
Signal	Indicates the strength of the radio frequency (RF) signal the client receives from the access point. The measure used for this is an IEEE 802.1x value known as Received SignalStrength Indication (RSSI), and will be a value between 0 and 100. RSSI is determined by an IEEE 802.1x mechanism implemented on the network interface card (NIC) of the client station.
Utilization	Utilization rate for this station. For example, if the station is "active" (transmitting and receiving data) 90% of the time and inactive 10% of the time, its "utilization rate" is 90%.

Field	Description
Rx Total	Indicates number of total packets received by the client during the current session.
Tx Total	Indicates number of total packets transmitted to the client during this session.
Error Rate	Indicates the percentage of time frames dropped during transmission on this access point.

Sorting Session Information

To order (sort) the information shown in the tables by a particular indicator, click on the column label by which you want to order things. For example, if you want to see the table rows ordered by Utilization rate, click on the **Utilization** column label. The entries will be sorted by Utilization rate.

Refreshing Session Information

You can force an update of the information displayed on the Session Monitoring page by clicking the **Refresh** button.

Chapter 7: Channel Management

The following Channel Management topics are covered here:

- Navigating to Channel Management
- Understanding Channel Management
  - How it Works in a Nutshell
  - For the Curious: More About Overlapping Channels
  - Example: A Network Before and After Channel Management
- Configuring and Viewing Channel Management Settings
  - Stopping/Starting Automatic Channel Assignment
  - Viewing Current Channel Assignments and Setting Locks
  - Update Current Channel Settings (Manual Setting)
  - Viewing Last Proposed Set of Changes
  - Configuring Advanced Settings (Customizing and Scheduling Channel Plans)
  - Update Advanced Settings

Navigating to Channel Management

To view session monitoring information, click the **Cluster > Channel Management** tab.

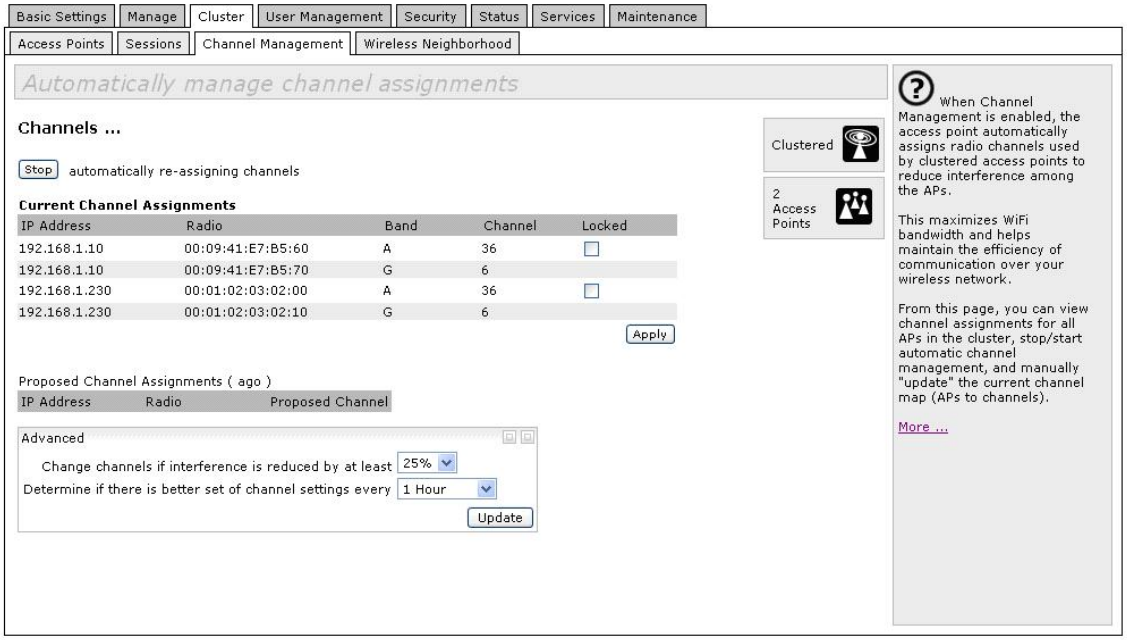


Figure 16: Channel Management Setting Page

Understanding Channel Management

When Channel Management is enabled, the AT-TQ2403 AP automatically assigns radio channels used by clustered access points to reduce mutual interference (or interference with other access points outside of its cluster). This maximizes Wi-Fi bandwidth and helps maintain the efficiency of communication over your wireless network.

(You must start channel management to get automatic channel assignments; it is disabled by default on a new AP. See "Stopping/Starting Automatic Channel Assignment".)

How it Works in a Nutshell

At a specified interval (the default is 1 hour) or on demand (click **Update**), the Channel Manager maps APs to channel use and measures interference levels in the cluster. If significant channel interference is detected, the Channel Manager automatically re-assigns some or all of the APs to new channels per an efficiency algorithm (or automated channel plan).

For the Curious: More About Overlapping Channels

The radio frequency (RF) broadcast Channel defines the portion of the radio spectrum that the radio on the access point uses for transmitting and receiving. The range of available channels for an access point is determined by the IEEE 802.11 mode (also referred to as band) of the access point.

IEEE 802.11 b/g support consecutive channels (for example, U.S uses channels 1 through 11) inclusive, while IEEE 802.11a mode supports a larger set of non-consecutive channels.

Interference can occur when multiple access points within range of each other are broadcasting on the same or overlapping channels. The impact of this interference on network performance can intensify during busy times when a large amount of data and media traffic is competing for bandwidth.

The Channel Manager detects which bands (b/g or a) clustered APs are on, and uses a predetermined collection of channels that will not mutually interfere. For the "b/g" radio band, the classical set of non-interfering channels is 1, 6, and 11. Channels 1, 4, 8, 11 produce minimal overlap. A similar set of non-interfering channels is used for the "a" radio band, which includes all channels for that mode since they are not overlapping.

Example: A Network Before and After Channel Management

Without automated channel management, channel assignments to clustered APs might be made on consecutive channels, which would overlap and cause interference. For example, AP1 could be assigned to channel 6, AP2 to channel 6, and AP3 to channel 5 as shown in below figure. APs can broadcast on overlapping channels without automated channel management.

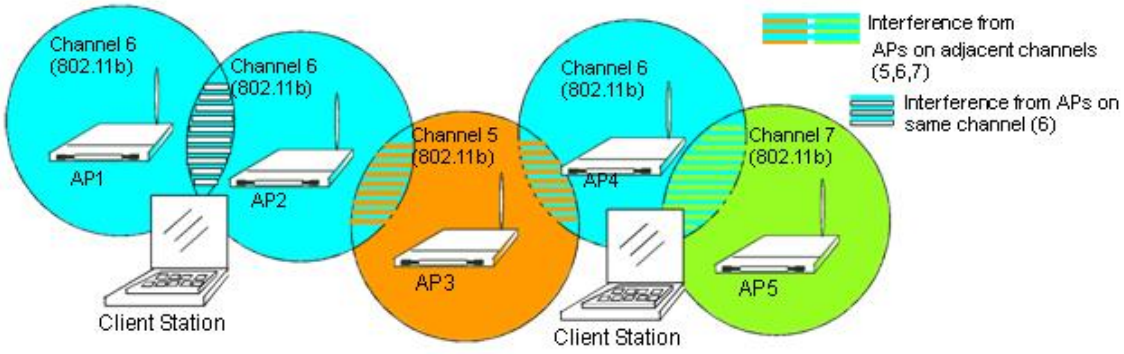


Figure 17: Before Channel Management Enable

With automated channel management, APs in the cluster are automatically re-assigned to non-interfering channels as shown in below figure.

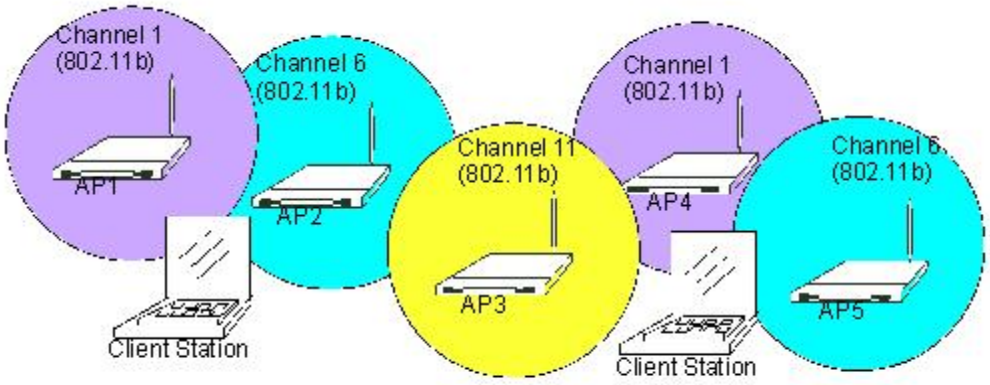


Figure 18: After Channel Management Enable

Configuring and Viewing Channel Management Settings

The Channel Management page shows previous, current, and planned channel assignments for clustered access points. By default, automatic channel assignment is disabled. You can start channel management to optimize channel usage across the cluster on a scheduled interval.

From this page, you can view channel assignments for all APs in the cluster, stop/start automatic channel management, and manually "update" the current channel map (APs to channels). On a manual update, the Channel Manager will assess channel usage and, if necessary, re-assign APs to new channels to reduce interference based on the current Advanced Settings.

By using the Advanced settings you can modify the interference reduction potential that triggers channel re-assignment, change the schedule for automatic updates, and re-configure the channel set used for assignments.

The following sections describe how to configure and use channel management on your network:

- Stopping/Starting Automatic Channel Assignment
- Viewing Current Channel Assignments and Setting Locks
- Update Current Channel Settings (Manual Setting)
- Viewing Last Proposed Set of Changes
- Configuring Advanced Settings (Customizing and Scheduling Channel Plans)
- Update Advanced Settings

Stopping/Starting Automatic Channel Assignment

By default, automatic channel assignment is disabled (off).

- Click **Start** to resume automatic channel assignment.

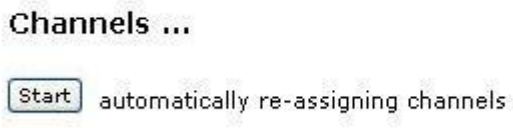


Figure 19: After Channel Management Enable

When automatic channel assignment is enabled, the Channel Manager periodically maps radio channels used by clustered access points and, if necessary, re-assigns channels on clustered APs to reduce interference (with cluster members or other APs outside the cluster).

Note: Channel Management overrides the default cluster behavior, which is to synchronize radio channels of all APs across a cluster. When Channel Management is enabled, the radio Channel is not synced across the cluster to other APs. See the note under Radio Settings in "Settings Shared in the Cluster Configuration".

- Click **Stop** to stop automatic channel assignment. (No channel usage maps or channel re-assignments will be made. Only manual updates will affect the channel assignment.)

Viewing Current Channel Assignments and Setting Locks

The "Current Channel Assignments" shows a list of all access points in the cluster by IP Address. The display shows the band on which each AP is broadcasting, the current channel used by each AP, and an option to "lock" an AP on its current radio channel so that it cannot be re-assigned to another. Details about Current Channel Settings are provided below.

Field	Description
IP Address	Specifies the IP Address for the access point.
Radio	Indicates the MAC address of the access point.
Band	Indicates the band (b/g or a) on which the access point is broadcasting.
Channel	Indicates the radio Channel on which this access point is currently broadcasting.
Locked	Click **Locked** if you want this access point to remain on the current channel. When the "Locked" checkbox is checked (enabled) for an access point, automated channel management plans will not re-assign the AP to a different channel as a part of the optimization strategy. For 5GHz band, because of DFS function (See "802.11h Regulatory Domain Control"), you might fail to lock the channel for the APs. If you click **Update**, you will see that locked APs show the same channel for "Current Channel" and "Proposed Channel". Locked APs will keep their current channels.

Update Current Channel Settings (Manual Setting)

You can run a manual channel management update at any time by clicking **Update** under the Advanced display.

Viewing Last Proposed Set of Changes

The Proposed Channel Assignments shows the last channel plan. The plan lists all access points in the cluster by IP Address, and shows the proposed channels for each AP. Locked channels will not be re-assigned and the optimization of channel distribution among APs will take into account the fact that locked APs must remain on their current channels. APs that are not "Locked" may be assigned to different channels than they were previously using, depending on the results of the plan.

Field	Description
IP Address	Specifies the IP Address for the access point.
Current	Indicates the radio channel on which this access point is currently broadcasting.
Proposed Channel	Indicates the radio channel to which this access point would be re-assigned if the Channel Plan is executed.

Configuring Advanced Settings (Customizing and Scheduling Channel Plans)

If you use Channel Management as provided (without updating Advanced Settings), channels are automatically fine-tuned once every hour if interference can be reduced by 25 percent or more. Channels will be re-assigned even if the network is busy. The appropriate channel sets will be used (b/g for APs using IEEE 802.11b/g and a for APs using IEEE 802.11a).

These defaults are designed to satisfy most scenarios where you would need to implement channel management.

You can use “Advanced Settings” to modify the interference reduction potential that triggers channel re-assignment, change the schedule for automatic updates, and re-configure the channel set used for assignments.

Field	Description
Advanced	Click "**Advanced**" toggle to show / hide display settings that modify timing and details of the channel planning algorithm. By default, these settings are hidden.

Field	Description
Change channels if interference is reduced by at least	Specify the minimum percentage of interference reduction a proposed plan must achieve in order to be applied. The default is 25 percent. Use the drop-down menu to choose percentages ranging from 5% to 75%. This setting lets you set a gating factor for channel reassignment so that the network is not continually disrupted for minimal gains in efficiency. For example, if channel interference must be reduced by 75 percent and the proposed channel assignments will only reduce interference by 30 percent, then channels will not be re-assigned. However; if you re-set the minimal channel interference benefit to 25 percent and click "**Update**", the proposed channel plan will be implemented and channels re-assigned as needed.
Determine if there is better set of channel settings every	Use the drop-down menu to specify the schedule for automated updates. A range of intervals is provided, from "1 Minute" to "6 Months". The default is "1 hour" (channel usage re-assessed and the resulting channel plan applied every hour). **Note:** Keep in mind that every time the channel planner is triggered, the AP's operating channel may change and clients will have to re-associate. Therefore, setting the planning interval for less than an hour can destabilize wireless access for clients.

Update Advanced Settings

Click **Update**, under "Advanced settings", to apply these settings.

Advanced settings will take affect when they are applied, and influence how automatic channel management is performed. (The new interference reduction minimum, scheduled tuning interval, channel set, and network busy settings will be taken into account for automated and manual updates.)

Chapter 8: Wireless Neighborhood

The Wireless Neighborhood view shows those access points within range of any access point in the cluster. This page provides a detailed view of neighboring access points including identifying information (SSIDs and MAC addresses) for each, cluster status (which are members and non-members), and statistical information such as the channel each AP is broadcasting on, signal strength, and so forth.

The following topics are covered here:

- Navigating to Wireless Neighborhood
- Understanding Wireless Neighborhood Information
- Viewing Wireless Neighborhood
- Viewing Details for a Cluster Member

Navigating to Wireless Neighborhood

To view the Wireless Neighborhood, click the **Cluster > Wireless Neighborhood** tab.

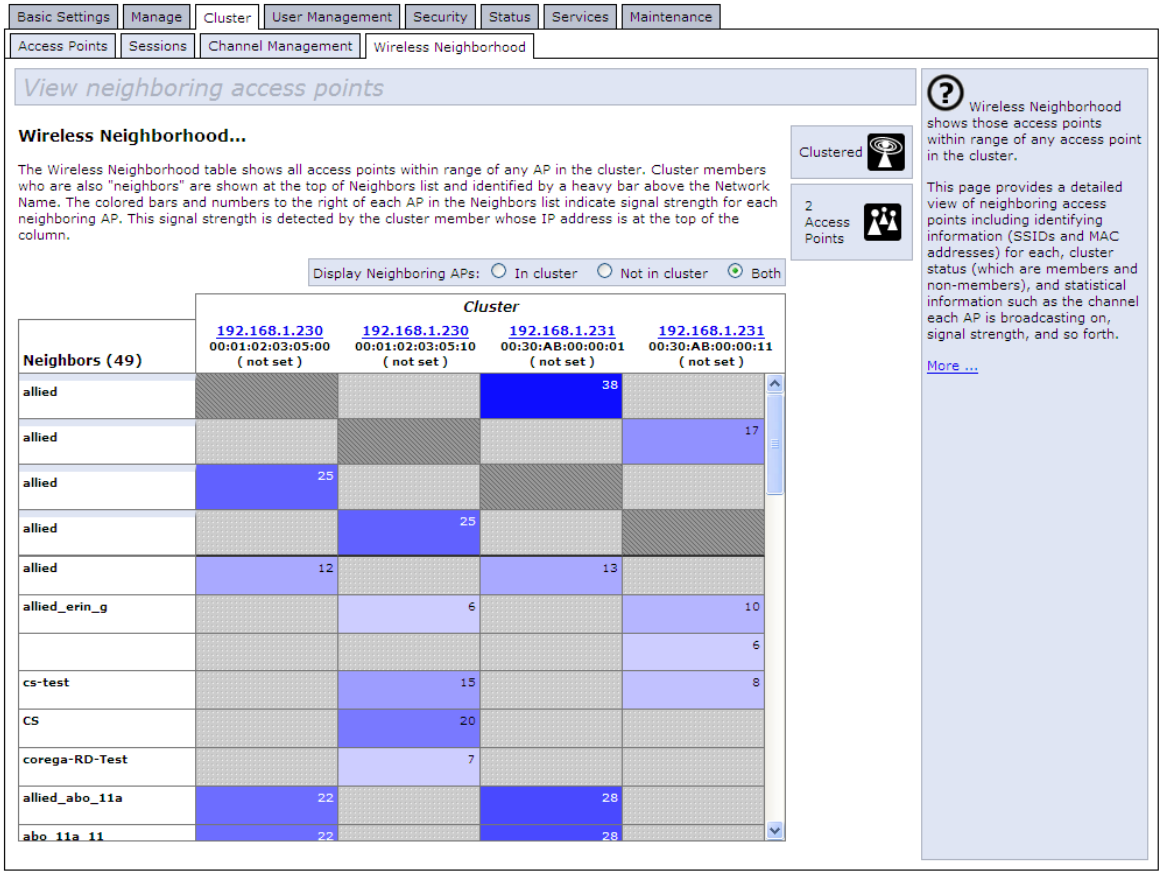


Figure 20: Wireless Neighborhood Page

Understanding Wireless Neighborhood Information

The Wireless Neighborhood shows all access points within range of every member of the cluster, shows which access points are within range of which cluster members, and distinguishes between cluster members and non-members.

For each neighbor access point, the Wireless Neighborhood view shows identifying information (SSID or Network Name, IP Address, MAC address) along with radio statistics (signal strength, channel, beacon interval). You can click on an AP to get additional statistics about the APs in radio range of the currently selected AP.

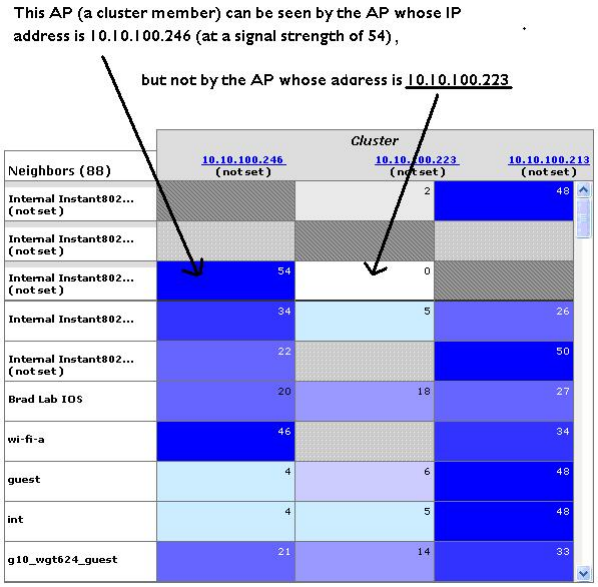
The Wireless Neighborhood view can help you:

- Detect and locate unexpected (or rogue) access points in a wireless domain so that you can take action to limit associated risks.
- Verify coverage expectations. By assessing which APs are visible at what signal strength from other APs, you can verify that the deployment meets your planning goals.
- Detect faults. Unexpected changes in the coverage pattern are evident at a glance in the color coded table.

Viewing Wireless Neighborhood

Details about Wireless Neighborhood information shown is described below.

Field	Description
Display Neighboring APs	Click one of the following radio buttons to change the view: • In cluster - Shows only neighbor APs that are members of the cluster • Not in cluster - Shows only neighbor APs that are not cluster members • Both - Shows all neighbor APs (cluster members and non-members)

Field	Description
Cluster	The **Cluster** list at the top of the table shows IP addresses for all access points in the cluster. (This is the same list of cluster members shown on the **Cluster > Access Points** tab described in "Navigating to Access Points Management".) If there is only one AP in the cluster, only a single IP address column will be displayed here; indicating that the AP is "clustered with itself". You can click on an IP address to view more details on a particular AP as shown in Figure below. Access points which are neighbors of one or more of the clustered APs are listed in the left column by SSID (Network Name). An access point which is detected as a neighbor of a cluster member can also be a cluster member itself. Neighbors who are also cluster members are always shown at the top of the list with a heavy bar above and include a location indicator. The colored bars to the right of each AP in the Neighbors list shows the signal strength for each of the neighbor APs as detected by the cluster member whose IP address is shown at the top of the column:  **Dark Blue Bar** - A dark blue bar and a high signal strength number (for example 50) indicates good signal strength detected from the Neighbor seen by the AP whose IP address is listed above that column. **Lighter Blue Bar** - A lighter blue bar and a lower signal strength number (for example 20 or lower) indicates medium or weak signal strength from the Neighbor seen by the AP whose IP address is listed above that column. **White Bar** - A white bar and the number 0 indicates that a neighboring AP that was detected by one of the cluster members cannot be detected by the AP whose IP address is listed above that column. **Light Gray Bar** - A light gray bar and no signal strength number indicates a Neighbor that is detected by other cluster members but not by the AP whose IP address is listed above that column. **Dark Gray Bar** - A dark gray bar and no signal strength number indicates this is the AP whose IP address is listed above that column (since it is not applicable to show how well the AP can detect itself).

Viewing Details for a Cluster Member

To view details on a cluster member AP, click on the IP address of a cluster member at the top of the page.

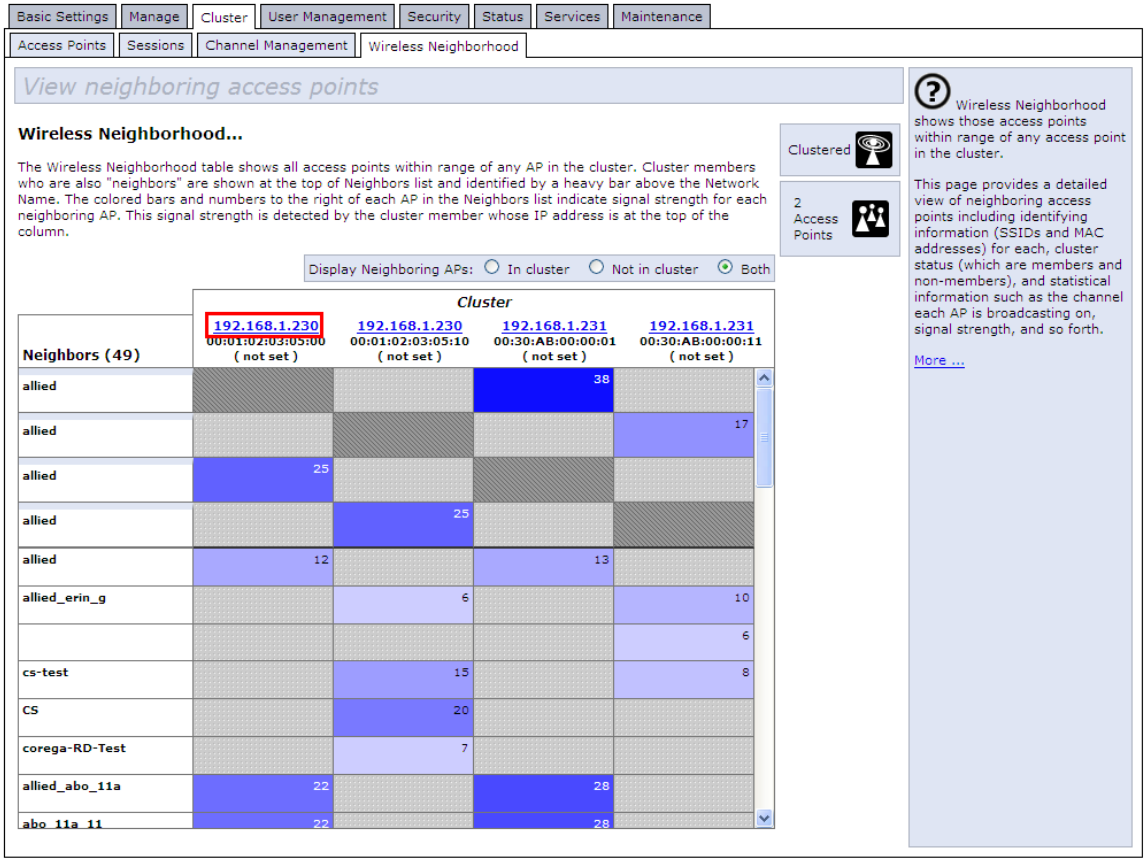


Figure 21: Cluster Member Setting Detail

The following table explains the details shown about the selected AP.

Field	Description
SSID	The Service Set Identifier (SSID) for the access point. A Guest network and an internal network running on the same access point must always have two different network names.
MAC Address	Shows the MAC address of the neighboring access point. A MAC address is a hardware address that uniquely identifies each node of a network.

Field	Description
Channel	Shows the channel on which the access point is currently broadcasting. The Channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving. The channel is set in **Manage > Radio**. (See "Configuring Radio Settings".)
Rate	Shows the rate (in megabits per second) at which this access point is currently transmitting. The current rate will always be one of the rates shown in Supported Rates.
Signal	Indicates the strength of the radio signal emitting from this access point as measured in decibels (dB).
Beacon Interval	Shows the Beacon interval being used by this access point. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second). The Beacon Interval is set on **Manage > Radio**. (See "Configuring Radio Settings")
Beacon Age	Shows the date and time of the most recent beacon that was transmitted from the access point.

Chapter 9: Configuring Security

The following sections describe how to configure Security settings on the AT-TQ2403 Management Software:

- Understanding Security Issues on Wireless Networks
  - How Do I Know Which Security Mode to Use?
  - Comparison of Security Modes for Key Management, Authentication and Encryption Algorithms
  - Does Prohibiting the Broadcast SSID Enhance Security?
- Navigating to Security Settings
- Configuring Security Settings
- Updating Settings

Understanding Security Issues on Wireless Networks

Wireless mediums are inherently less secure than wired mediums. For example, an Ethernet NIC transmits its packets over a physical medium such as coaxial cable or twisted pair. A wireless NIC broadcasts radio signals over the air allowing a wireless LAN to be easily tapped without physical access or sophisticated equipment. A hacker equipped with a laptop, a wireless NIC, and a bit of knowledge can easily attempt to compromise your wireless network. One does not even need to be within normal range of the access point. By using a sophisticated antenna on the client, a hacker may be able to connect to the network from many miles away.

The AT-TQ2403 Management Software provides a number of authentication and encryption schemes to ensure that your wireless infrastructure is accessed only by the intended users. The details of each security mode are described in the sections below.

See also the related topic, "Appendix A: Security Settings on Wireless Clients and RADIUS Server Setup".

How Do I Know Which Security Mode to Use?

In general, we recommend that on your Internal network you use the most robust security mode that is feasible in your environment. When configuring security on the access point, you first must choose the security mode, then in some modes an authentication algorithm, and whether to allow clients not using the specified security mode to associate.

Wi-Fi Protected Access (WPA) with Remote Authentication Dial-In User Service (RADIUS) using the CCMP (AES) encryption algorithm provides the best data protection available and is clearly the best choice if all client stations are equipped with WPA supplicants. However, backward compatibility or interoperability issues with clients or even with other access points may require that you configure WPA with RADIUS with a different encryption algorithm or choose one of the other security modes.

That said, however, security may not be as much of a priority on some types of networks. If you are simply providing internet and printer access, as on a guest network, setting the security mode to **None (Plain-text)** may be the appropriate choice. To prevent clients from accidentally discovering and connecting to your network, you can disable the broadcast SSID so that your network name is not advertised. If the network is sufficiently isolated from access to sensitive information, this may offer enough protection in some situations. This level of protection is the only one offered for guest networks,

and also may be the right convenience trade-off for other scenarios where the priority is making it as easy as possible for clients to connect. (See "Does Prohibiting the Broadcast SSID Enhance Security?")

Following is a brief discussion of what factors make one mode more secure than another, a description of each mode offered, and when to use each mode.

Comparison of Security Modes for Key Management, Authentication and Encryption Algorithms

Three major factors that determine the effectiveness of a security protocol are:

- How the protocol manages keys
- Presence or absence of integrated user authentication in the protocol
- Encryption algorithm or formula the protocol uses to encode/decode the data

Following is a list of the security modes available on the AT-TQ2403 Management Software along with a description of the key management, authentication, and encryption algorithms used in each mode. We include some suggestions as to when one mode might be more appropriate than another.

- When to Use Unencrypted (No Security)
- When to Use Static WEP
- When to Use IEEE 802.1x
- When to Use WPA Personal
- When to Use WPA Enterprise

When to Use Unencrypted (No Security)

Setting the security mode to **None (Plain-text)** by definition provides no security. In this mode, the data is not encrypted but rather sent as "plain-text" across the network. No key management, data encryption or user authentication is used.

Recommendations

Unencrypted mode, i.e. None (Plain-text), is **not recommended** for regular use on the Internal network because it is not secure. This is the only mode in which you can run the Guest network, which is by definition an insecure LAN, always virtually separated from any sensitive information on the Internal LAN.

Therefore, only set the security mode to **None (Plain-text)** on the Guest network, and on the Internal network for initial setup, testing, or problem solving only.

See Also

For information on how to configure unencrypted security mode, see "None (Plain-text)" on under "Configuring Security Settings".

When to Use Static WEP

Static WEP (Wired Equivalent Privacy) is a data encryption protocol for 802.11 wireless networks. All wireless stations and access points on the network are configured with a static **64-bit** (40-bit secret key

+ 24-bit initialization vector (IV)) or **128-bit** (104-bit secret key + 24-bit IV) **Shared Key** for data encryption.

Key Management	Encryption Algorithm	User Authentication
Static WEP uses a fixed key that is provided by the administrator. WEP keys are indexed in different slots (up to four on the AT-TQ2403 Management Software). The client stations must have the same key indexed in the same slot to access data on the access point.	An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each 802.11 frame.	If you set the Authentication Algorithm to **Shared Key**, this protocol provides a rudimentary form of user authentication. However, if the Authentication Algorithm is set to **Open System**, no authentication is performed. If the algorithm is set to **Both**, only WEP clients are authenticated.

Recommendations

Static WEP was designed to provide security equivalent of sending unencrypted data through an Ethernet connection, however it has major flaws and it does not provide even this intended level of security.

Therefore, **Static WEP is not recommended** as a secure mode. The only time to use Static WEP is when interoperability issues make it the only option available to you and you are not concerned with the potential of exposing the data on your network.

See Also

For information on how to configure Static WEP security mode, see "Static WEP" under "Configuring Security Settings".

When to Use IEEE 802.1x

IEEE 802.1x is the standard for passing the Extensible Authentication Protocol (EAP) over an 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). This is a newer, more secure standard than Static WEP.

Key Management	Encryption Algorithm	User Authentication
IEEE 802.1x provides dynamically- generated keys that are periodically refreshed.	An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each 802.11 frame.	IEEE 802.1x mode supports a variety of authentication methods, like certificates, Kerberos, and public key authentication with a RADIUS server.

Recommendations

IEEE 802.1x mode is a better choice than Static WEP because keys are dynamically generated and changed periodically. However, the encryption algorithm used is the same as that of Static WEP and is therefore not as reliable as the more advanced encryption methods such as TKIP and CCMP (AES) used in Wi-Fi Protected Access (WPA) or WPA2.

Additionally, compatibility issues may be cumbersome because of the variety of authentication methods supported and the lack of a standard implementation method.

Therefore, IEEE 802.1x mode is not as secure a solution as Wi-Fi Protected Access (WPA) or WPA2. If, you cannot use WPA because some of your client stations do not have WPA, then a better solution than using IEEE 802.1x mode is to use WPA Enterprise mode.

See Also

For information on how to configure IEEE 802.1x security mode, see "IEEE 802.1x" under "Configuring Security Settings".

When to Use WPA Personal

Wi-Fi Protected Access Personal Pre-Shared Key (PSK) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes Advanced Encryption Algorithm (AES), Counter mode/CBC-MAC Protocol (CCMP), and Temporal Key Integrity Protocol (TKIP) mechanisms. This mode offers the same encryption algorithms as WPA2 with RADIUS but without the ability to integrate a RADIUS server for user authentication.

This security mode is backwards-compatible for wireless clients that support only the original WPA.

Key Management	Encryption Algorithm	User Authentication
WPA Personal provides dynamically- generated keys that are periodically refreshed. There are different Unicast keys for each station.	• Temporal Key Integrity Protocol (TKIP) • Counter mode / CBC-MAC Protocol (CCMP) Advanced Encryption Standard (AES)	The use of a Pre-Shared (PSK) key provides user authentication similar to that of shared keys in WEP.

Recommendations

WPA Personal is not recommended for use with the AT-TQ2403 Management Software when WPA Enterprise is an option.

We recommend that you use WPA Enterprise mode instead, unless you have interoperability issues that prevent you from using this mode.

For example, some devices on your network may not support WPA or WPA2 with EAP talking to a RADIUS server. Embedded printer servers or other small client devices with very limited space for implementation may not support RADIUS. For such cases, we recommend that you use WPA Personal.

See Also

For information on how to configure this security mode, see "WPA Personal" under "Configuring Security Settings".

When to Use WPA Enterprise

Wi-Fi Protected Access Enterprise with Remote Authentication Dial-In User Service (RADIUS) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes Advanced Encryption Standard (AES), Counter mode/CBC-MAC Protocol (CCMP), and Temporal Key Integrity Protocol (TKIP) mechanisms. This mode requires the use of a RADIUS server to authenticate users. WPA Enterprise provides the best security available for wireless networks.

This security mode also provides backwards-compatibility for wireless clients that support only the original WPA.

Key Management	Encryption Algorithm	User Authentication
WPA Enterprise mode provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	• Temporal Key Integrity Protocol (TKIP) • Counter mode / CBC-MAC Protocol (CCMP) Advanced Encryption Standard (AES)	Remote Authentication Dial-In User Service (RADIUS) You have a choice of using the AT-TQ2403 Management Software RADIUS server or an external RADIUS server. The embedded RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

Recommendations

WPA Enterprise mode is the recommended mode. The CCMP (AES) and TKIP encryption algorithms used with WPA modes are far superior to the RC4 algorithm used for Static WEP or IEEE 802.1x modes. Therefore, CCMP (AES) or TKIP should be used whenever possible. All WPA modes allow you to use these encryption schemes, so WPA security modes are recommended above the others when using WPA is an option.

Additionally, this mode incorporates a RADIUS server for user authentication which gives it an edge over WPA Personal mode.

Use the following guidelines for choosing options within the WPA Enterprise mode security mode:

1. The best security you can have to date on a wireless network is WPA Enterprise mode using CCMP (AES) encryption algorithm. AES is a symmetric 128-bit block data encryption technique that works on multiple layers of the network. It is the most effective encryption system currently available for wireless networks. If all clients or other APs on the network are WPA/CCMP compatible, use this encryption algorithm. (If all clients are WPA2 compatible, choose to support only WPA2 clients.)

2. The second best choice is WPA Enterprise with the encryption algorithm set to both TKIP and CCMP. This lets WPA client stations without CCMP associate, uses TKIP for encrypting Multicast and Broadcast frames, and allows clients to select whether to use CCMP or TKIP for unicast (AP-to-single- station) frames. This WPA configuration allows more interoperability, at the expense of some security. Client stations that support CCMP can use it for their unicast frames. If you encounter AP-to-station interoperability problems with the **Both** encryption algorithm setting, then you will need to select TKIP instead. (See [3])

3. The third best choice is WPA Enterprise with the encryption algorithm set to TKIP. Some clients have interoperability issues with CCMP and TKIP enabled at same time. If you encounter this problem, then choose TKIP as the encryption algorithm. This is the standard WPA mode, and most interoperable mode with client Wireless software security features. TKIP is the only encryption algorithm that is being tested in Wi-Fi WPA certification.

See Also

For information on how to configure this security mode, see "WPA Enterprise" under "Configuring Security Settings".

Does Prohibiting the Broadcast SSID Enhance Security?

You can suppress (prohibit) this broadcast to discourage stations from automatically discovering your access point. When the AP's broadcast SSID is suppressed, the network name will not be displayed in the List of Available Networks on a client station. Instead, the client must have the exact network name configured in the supplicant before it will be able to connect.

Disabling the broadcast SSID is sufficient to prevent clients from accidentally connecting to your network, but it will not prevent even the simplest of attempts by a hacker to connect, or monitor unencrypted traffic.

This offers a very minimal level of protection on an otherwise exposed network (such as a guest network) where the priority is making it easy for clients to get a connection and where no sensitive information is available.

Navigating to Security Settings

To set the security mode, navigate to the **Security** tab, and update the fields as described below.

Figure 22: Security Setting Page

Configuring Security Settings

The following configuration information explains how to configure security modes on the access point. Keep in mind that each wireless client that wants to exchange data with the access point must be configured with the same security mode and encryption key settings consistent with access point security.

These Security Settings apply to both radios.

Note: Security modes other than Plain-text apply only to configuration of the "Internal" network. On the "Guest" network, you can use only Plain-text mode. (For more information about guest networks, see "Setting up Guest Access".)

Broadcast SSID, Station Isolation, and Security Mode

To configure security on the access point, select a security mode and fill in the related fields as described in the following table. (Note you can also allow or prohibit the Broadcast SSID and enable/disable Station Isolation as extra precautions as mentioned below.)

Field	Description
Broadcast SSID	To **enable** the Broadcast SSID, select the checkbox directly beside it. By default, the access point broadcasts (allows) the Service Set Identifier (SSID) in its beacon frames. You can suppress (prohibit) this broadcast to discourage stations from automatically discovering your access point. When the AP's broadcast SSID is suppressed, the network name will not be displayed in the List of Available Networks on a client station. Instead, the client must have the exact network name configured in the supplicant before it will be able to connect.
Station Isolation	To enable station isolation, select the checkbox directly beside it. • When **disabled**, wireless clients can communicate with one another normally by sending traffic through the access point. • When **enabled**, the access point blocks communication between wireless clients. The access point still allows data traffic between its wireless clients and wired devices on the network, but not among wireless clients. The traffic blocking extends to wireless clients connected to the network via WDS links; these clients cannot communicate with each other when Station Isolation is on. See "Configuring the Wireless Distribution System (WDS)" for more information about WDS.
Deny communication between Radio 1 and Radio 2	To enable Deny communication between Radio 1 and Radio 2, select the checkbox directly beside it. • When **disabled**, wireless clients connected to radio 1 can communicate with those connected to radio 2 normally by sending traffic through the access point. • When **enabled**, the access point blocks communication between the wireless clients connecting to radio 1 and the wireless clients connected to radio 2. The access point still allows data traffic among its wireless clients connected to the same radio, but not across radios. The blocking will not take effect to wireless clients connected to the network via WDS links; for example, wireless clients connected to radio 1 can communicate with wireless clients connected to the network via WDS even though Deny communication between Radio 1 and Radio 2 is on. **Note:** When Station Isolation is enabled, Deny communication between Radio 1 and Radio 2 will also be enabled automatically.

Field	Description
Security Mode	Select the **Security Mode**. Select one of the following: • None (Plain-text) • Static WEP • IEEE 802.1x • WPA Personal • WPA Enterprise For a Guest network, the only security mode that can be applied is **None (Plain-text)**. (For more information, see "Setting up Guest Access".) Security modes other than **None (Plain-text)** apply only to configuration of the "Internal" network.

None (Plain-text)

None (or Plain-text security) means any data transferred to and from the AT-TQ2403 Management Software is not encrypted.

If you select **None (Plain-text)** as your security mode, no further options are configurable on the AP. This security mode can be useful during initial network configuration or for problem solving, but it is not recommended for regular use on the Internal network because it is not secure.

Figure 23: Security Setting Page – None (Plain-text) Setting

Guest Network

Setting security to **None (Plain-text)** is the only mode in which you can run the Guest network, which is by definition an easily accessible, insecure LAN always virtually separated from any sensitive information on the Internal LAN. For example, the guest network might simply provide internet and printer access for day visitors.

The absence of security on the Guest AP is designed to make it as easy as possible for guests to get a connection without having to program any security settings in their clients.

For a minimum level of protection on a guest network, you can choose to suppress (prohibit) the broadcast of the SSID (network name) to discourage client stations from automatically discovering your access point. (See also "Does Prohibiting the Broadcast SSID Enhance Security?").

For more about the Guest network, see "Setting up Guest Access".

Static WEP

Wired Equivalent Privacy (WEP) is a data encryption protocol for 802.11 wireless networks. All wireless stations and access points on the network are configured with a static **64-bit** (40-bit secret key + 24-bit initialization vector (IV)), **128-bit** (104-bit secret key + 24-bit IV), or **152-bit** (128-bit secret key + 24-bit IV) **Shared Key** for data encryption.

You cannot mix 64-bit, 128-bit, and 152-bit WEP keys between the access point and its client stations.

Static WEP is not the most secure mode available, but it offers more protection than setting the security mode to **None (Plain-text)** as it does prevent an outsider from easily sniffing out unencrypted wireless traffic. (For more secure modes, see the sections on "IEEE 802.1x", "WPA Enterprise", or "WPA Personal".)

WEP encrypts data moving across the wireless network based on a static key. (The encryption algorithm is a "stream" cipher called RC4.)

The access point uses a key to transmit data to the client stations. Each client station must use that same key to decrypt data it receives from the access point.

Client stations can use different keys to transmit data to the access point. (Or they can all use the same key, but this is less secure because it means one station can decrypt the data being sent by another.)

If you selected **Static WEP** Security Mode, provide the following on the access point settings:

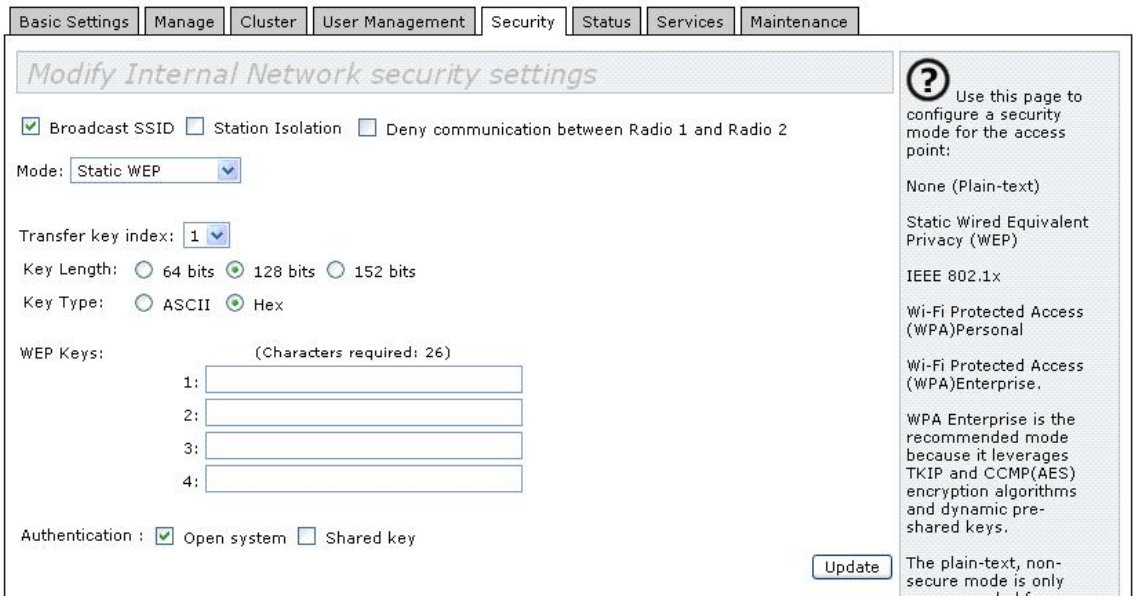


Figure 24: Security Setting Page – Static WEP Setting

Field	Description
Transfer Key Index	Select a key index from the drop-down menu. Key indexes 1 through 4 are available. The default is 1. The Transfer Key Index indicates which WEP key the access point will use to encrypt the data it transmits.
Key Length	Specify the length of the key by clicking one of the radio buttons: • 64 bits • 128 bits • 152 bits
Key Type	Select the key type by clicking one of the radio buttons: • ASCII • Hex
WEP Keys	You can specify up to four WEP keys. In each text box, enter a string of characters for each key. If you selected **ASCII**, enter any combination ASCII characters. If you selected **HEX**, enter hexadecimal digits (any combination of 0-9 and a-f or A-F). Use the same number of characters for each key as specified in the "Characters Required" field. These are the RC4 WEP keys shared with the stations using the access point. Each client station must be configured to use one of these same WEP keys in the same slot as specified here on the AP. (See "Rules to Remember for Static WEP".) **Characters Required: 26** indicates the number of characters required in the WEP key. The number of characters required updates automatically based on how you set Key Length and Key Type.

Field	Description
Authentication	The authentication algorithm defines the method used to determine whether a client station is allowed to associate with an access point when static WEP is the security mode. Specify the authentication algorithm you want to use by choosing one of the following options: • Open System • Shared Key **Note:** You can also select both the Open System and Shared Key checkboxes. **Open System:** This authentication allows any client station to associate with the access point whether that client station has the correct WEP key or not. This is algorithm is also used in plaintext, IEEE 802.1x, and WPA modes. When the authentication algorithm is set to **Open System**, any client can associate with the access point. Note that just because a client station is allowed to associate does not ensure it can exchange traffic with an access point. A station must have the correct WEP key to be able to successfully access and decrypt data from an access point, and to transmit readable data to the access point. **Shared Key:** This authentication requires the client station to have the correct WEP key in order to associate with the access point. When the authentication algorithm is set to **Shared Key**, a station with an incorrect WEP key will not be able to associate with the access point. When you select both **Open System and Shared Key** authentication algorithms: • Client stations configured to use **WEP** in **shared key** mode must have a valid WEP key in order to associate with the access point. • Client stations configured to use **WEP** as an **open system** (shared key mode not enabled) will be able to associate with the access point even if they do not have the correct WEP key.

Rules to Remember for Static WEP

- All client stations must have the Wireless LAN (WLAN) security set to **WEP** and all clients must have one of the WEP keys specified on the AP in order to de-code AP-to-station data transmissions.
- The AP must have all keys used by clients for station-to-AP transmit so that it can de-code the station transmissions.
- The same key must occupy the same slot on all nodes (AP and clients). For example if the AP defines abc123 key as WEP key 3, then the client stations must define that same string as WEP key 3.
- On some wireless client software (like Funk Odyssey), you can configure multiple WEP keys and define a client station "transfer key index", and then set the stations to encrypt the data they transmit using different keys. This ensures that neighboring APs cannot decode each other's transmissions.

Example of Using Static WEP

For a simple example, suppose you configure three WEP keys on the access point. In our example, the

Transfer Key Index for the AP is set to "3". This means that the WEP key in slot "3" is the key the access point will use to encrypt the data it sends.

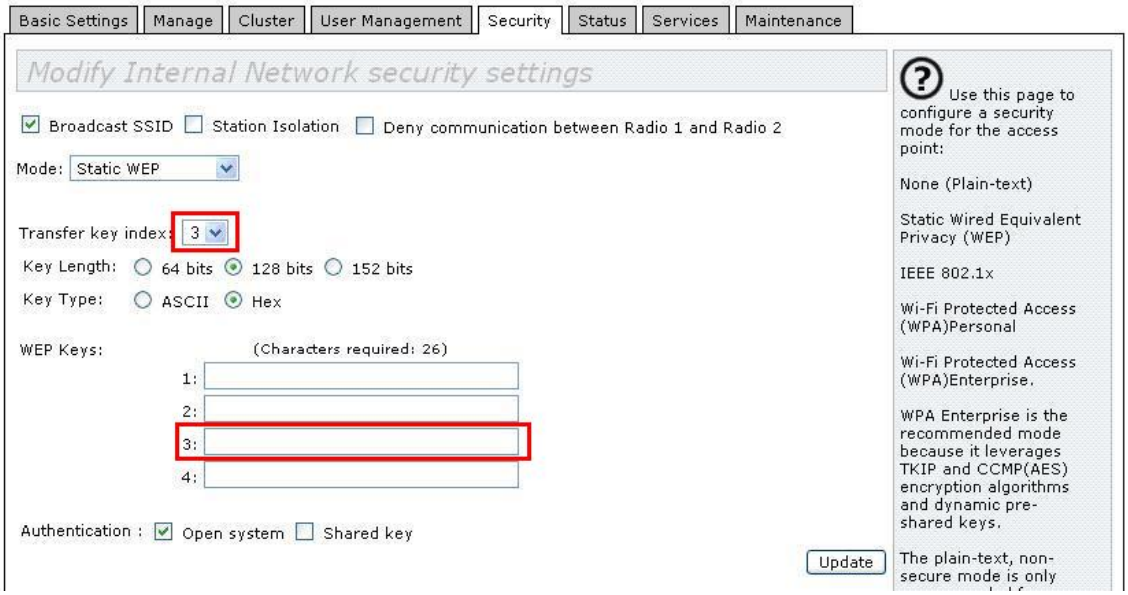


Figure 25: Security Setting Page – Static WEP Setting Example

You must then set all client stations to use **WEP** and provide each client with one of the slot/key combinations you defined on the AP.

For this example, we'll set WEP key 1 on a Windows client as below figure.

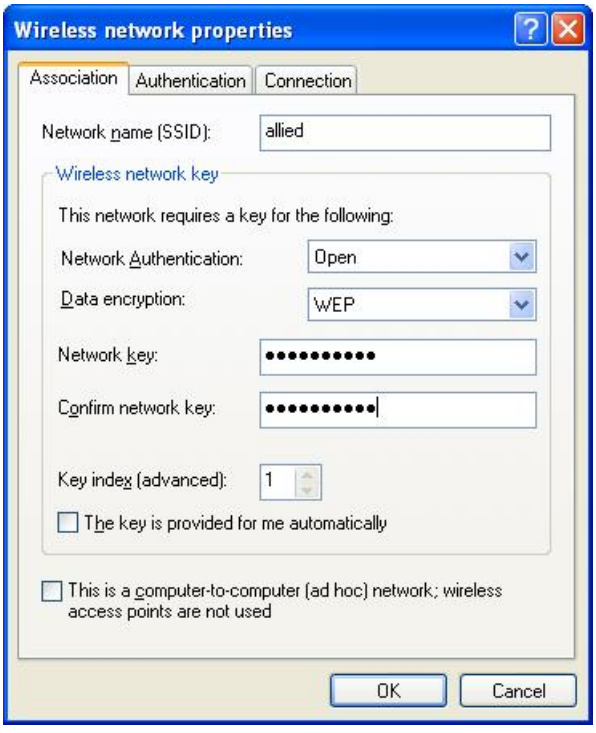


Figure 26: Providing a Wireless Client with a WEP Key

If you have a second client station, that station also needs to have one of the WEP keys defined on the AP. You could give it the same WEP key you gave to the first station. Or for a more secure solution, you could give the second station a different WEP key (key 2, for example) so that the two stations cannot decrypt each other's transmissions.

Static WEP with Transfer Key Indexes on Client Stations

Some Wireless client software (like Funk Odyssey) lets you configure multiple WEP keys and set a transfer index on the client station, then you can specify different keys to be used for station-to-AP transmissions. (The standard Windows wireless client software does not allow you to do this.)

To build on our example, using Funk Odyssey client software you could give each of the clients WEP key 3 so that they can decode the AP transmissions with that key and also give client 1 WEP key 1 and set this as its transfer key. You could then give client 2 WEP key 2 and set this as its transfer key index.

The following figure illustrates the dynamics of the AP and two client stations using multiple WEP keys and a transfer key index.

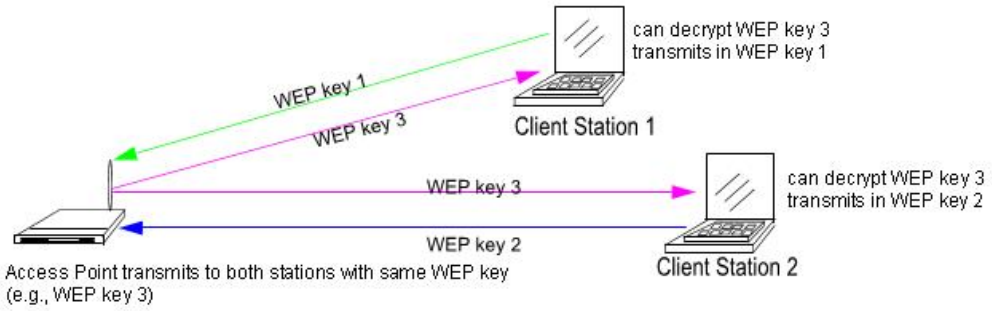


Figure 27: Example of Using Multiple WEP Keys and Transfer Key Index on Client Stations

IEEE 802.1x

IEEE 802.1x is the standard defining port-based authentication and infrastructure for doing key management. Extensible Authentication Protocol (EAP) messages sent over an IEEE 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). IEEE 802.1x provides dynamically-generated keys that are periodically refreshed. An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each 802.11 frame.

This mode requires the use of a RADIUS server to authenticate users. If the option for the **Use internal RADIUS server** is enabled, configure user accounts on the AP via the **User Management** tab. Otherwise configure user accounts on the external RADIUS server.

The access point requires a RADIUS server capable of EAP, such as the Microsoft Internet Authentication Server or the AT-TQ2403 Management Software internal authentication server. To work with Windows clients, the authentication server must support Protected EAP (PEAP) and MSCHAP V2.

When configuring IEEE 802.1x mode, you have a choice of whether to use the embedded RADIUS server or an external RADIUS server that you provide. The AT-TQ2403 Management Software embedded RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

If you use your own RADIUS server, you have the option of using any of a variety of authentication methods that the IEEE 802.1x mode supports, including certificates, Kerberos, and public key authentication. Keep in mind, however, that the client stations must be configured to use the same authentication method being used by the access point.

If you selected **IEEE 802.1x** Security Mode, provide the following:

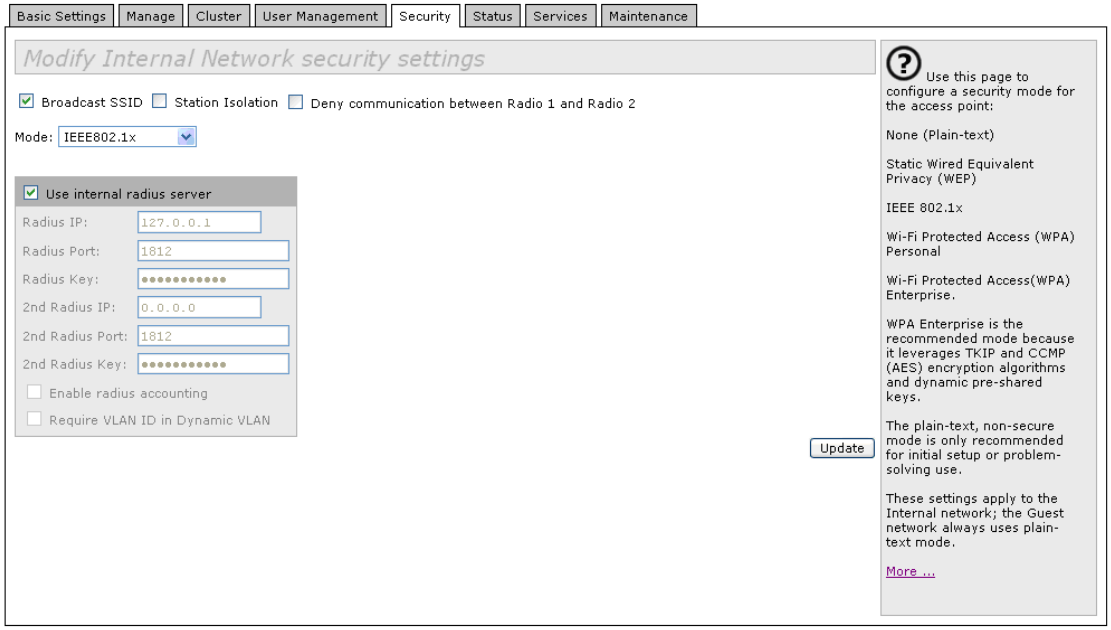


Figure 28: Security Setting Page – IEEE802.1x Setting Page

Field	Description
Use internal radius server	You can choose whether to use the built-in authentication server provided with the AT-TQ2403 Management Software, or you can use an external radius server. • To use the authentication server provided with the AT-TQ2403 Management Software, ensure the checkbox beside the **Use internal radius server** field is selected. If this option is selected, you do not have to provide the Radius IP and Radius Key; they are automatically provided. If the option for the internal RADIUS server is enabled, configure user accounts on the AP via the **User Management** tab. For more information, see "Managing User Accounts". • To use an external authentication server, ensure the checkbox beside the **Use internal radius server** field is deselected. If you deselect this checkbox you must supply a **Radius IP** and **Radius Key** of the server you want to use. **Note:** The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides. On the current release of the AT-TQ2403 Management Software, the RADIUS server User Datagram Protocol (UDP) ports used by the access point are not configurable. (The AT-TQ2403 Management Software is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.)

Field	Description
Radius IP	Enter the Radius IP in the text box. The Radius IP is the IP address of the RADIUS server. You can configure two RADIUS servers. The secondary server only when the first server is not available. If the IP address of secondary server is "0.0.0.0", it implies to disable secondary server. (The AT-TQ2403 Management Software internal authentication server is **127.0.0.1**) For information on setting up user accounts, see "Managing User Accounts"
Radius Port	Enter the Radius Port in the text box. The Radius Port is the port number of the RADIUS server. (The port of AT-TQ2403 internal RADIUS server is **1812**.)
Radius Key	Enter the Radius Key in the text box. The Radius Key is the shared secret key for the RADIUS server. The text you enter will be displayed as " * " characters to prevent others from seeing the RADIUS key as you type. (The AT-TQ2403 Management Software internal authentication server key is secret. This value is never sent over the network.) Radius Key is a string of up to 128 characters.
Enable radius accounting	Click the checkbox beside **Enable radius accounting** if you want to track and measure the resources a particular user has consumed such system time, amount of data transmitted and received, and so on.
Require VLAN ID in Dynamic VLAN	Dynamic mode is **enabled** when you click the checkbox. If you have enabled dynamic mode and try to establish wireless connection between wireless client and AP, the AP must receive VLAN ID information from Radius server in authentication process. Otherwise, the AP will reject wireless connection to the wireless client. The default setting is unchecked the checkbox, which means dynamic mode is disable.

WPA Personal

Wi-Fi Protected Access Personal is a Wi-Fi Alliance IEEE 802.11i standard, which includes Counter mode/ CBC-MAC Protocol-Advanced Encryption Algorithm - (CCMP-AES), and Temporal Key Integrity Protocol (TKIP) mechanisms. The Personal version of WPA employs a pre-shared key (instead of using IEEE802.1x and EAP as is used in the Enterprise WPA security mode). The PSK is used for an initial check of credentials only.

This security mode is backwards-compatible for wireless clients that support the original WPA.

If you selected **WPA Personal** Security Mode, provide the following:

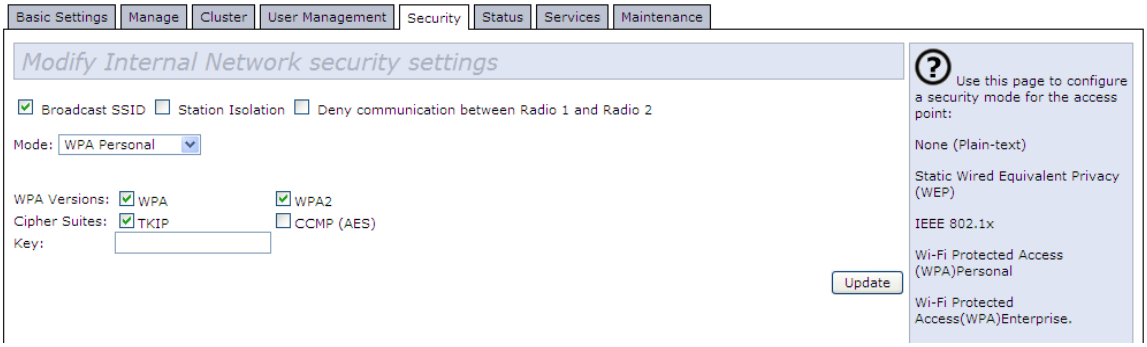


Figure 29: Security Setting Page – WPA Personal Setting Page

Field	Description
WPA Versions	Select the types of client stations you want to support: • WPA • WPA2 • Both **WPA:** If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. **WPA2:** If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. **Both:** If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select **Both**. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.

Field	Description
Cipher Suites	Select the cipher suite you want to use: • TKIP • CCMP (AES) • Both Temporal Key Integrity Protocol (TKIP) is the default. **TKIP:** It provides a more secure encryption solution than WEP keys. The TKIP process more frequently changes the encryption key used and better ensures that the same key will not be re-used to encrypt data (a weakness of WEP). TKIP uses a 128-bit "temporal key" shared by clients and access points. The temporal key is combined with the client's MAC address and a 16-octet initialization vector to produce the key that will encrypt the data. This ensures that each client station uses a different key to encrypt data. TKIP uses RC4 to perform the encryption, which is the same as WEP. But TKIP changes temporal keys every 10,000 packets and distributes them, thereby greatly improving the security of the network. **CCMP (AES):** Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES). It uses a CCM combined with Cipher Block Chaining Counter mode (CBC-CTR) and Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity. **Both:** If you select both TKIP and CCMP(AES), Pairwise cipher is AES and Groupwise cipher is TKIP. Pairwise cipher is used for unicast traffic and Groupwise cipher is used for multicast/ broadcast traffic. Both TKIP and AES clients can associate with the access point. WPA clients must have one of the following to be able to associate with the AP: • A valid TKIP key • A valid CCMP (AES) key Clients not configured to use a WPA Personal will not be able to associate with AP.
Key	The Pre-shared Key is the shared secret key for WPA Personal. Enter a string of at least 8 characters to a maximum of 63 characters.

WPA Enterprise

Wi-Fi Protected Access Enterprise with Remote Authentication Dial-In User Service (RADIUS) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes Advanced Encryption Standard (AES), Counter mode/CBC-MAC Protocol (CCMP), and Temporal Key Integrity Protocol (TKIP) mechanisms. The Enterprise mode requires the use of a RADIUS server to authenticate users, and configuration of user accounts via the **User Management** tab.

This security mode is backwards-compatible with wireless clients that support the original WPA. When configuring WPA Enterprise mode, you have a choice of whether to use the built-in RADIUS server or an external RADIUS server that you provide. The AT-TQ2403 Management Software built-in RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

If you selected **WPA Enterprise** security mode, provide the following:

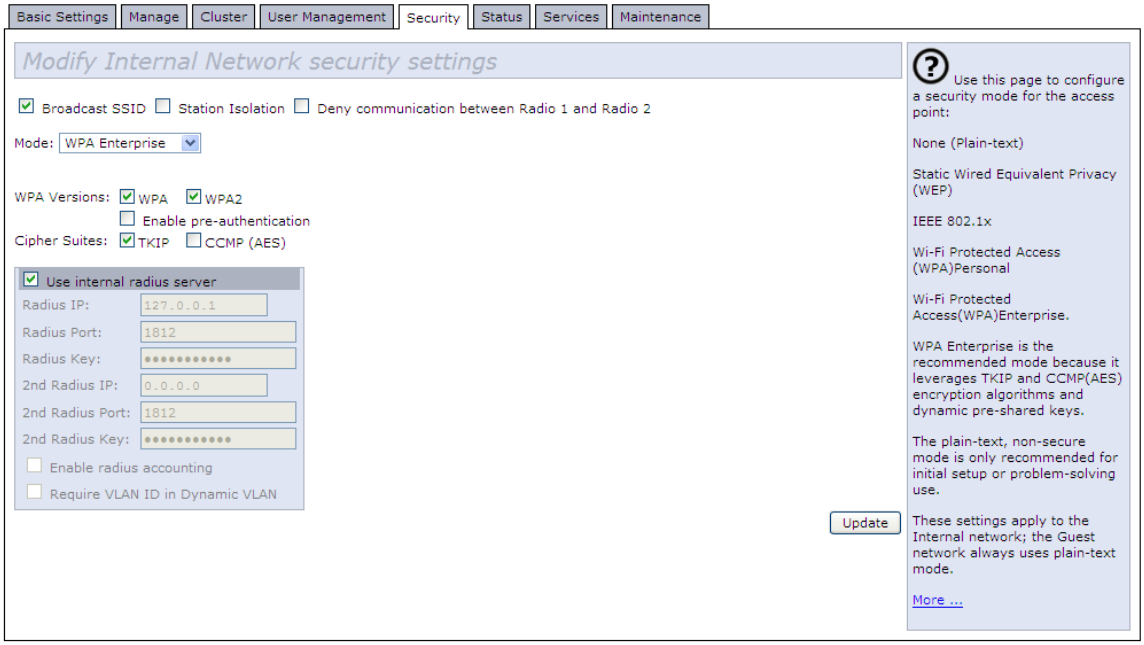


Figure 30: Security Setting Page – WPA Enterprise Setting Page

Field	Description
WPA Versions	Select the types of client stations you want to support: • WPA • WPA2 • Both **WPA:** If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. **WPA2:** If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. **Both:** If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both WPA and WPA2. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.
Enable pre-authentication	If for WPA Versions you select only WPA2 or both WPA and WPA2, you can enable pre- authentication for WPA2 clients. Click **Enable pre-authentication** if you want WPA2 wireless clients to send pre-authentication packet. The pre-authentication information will be relayed from the access point the client is currently using to the target access point. Enabling this feature can help speed up authentication for roaming clients who connect to multiple access points. This option does not apply if you selected **WPA** for WPA Versions because the original WPA does not support this feature.

Field	Description
Cipher Suites	Select the cipher you want to use: • TKIP • CCMP (AES) • Both Temporal Key Integrity Protocol (TKIP) is the default. **TKIP:** It provides a more secure encryption solution than WEP keys. The TKIP process more frequently changes the encryption key used and better ensures that the same key will not be re-used to encrypt data (a weakness of WEP). TKIP uses a 128-bit "temporal key" shared by clients and access points. The temporal key is combined with the client's MAC address and a 16-octet initialization vector to produce the key that will encrypt the data. This ensures that each client station uses a different key to encrypt data. TKIP uses RC4 to perform the encryption, which is the same as WEP. But TKIP changes temporal keys every 10,000 packets and distributes them, thereby greatly improving the security of the network. **CCMP (AES):** Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES). It uses a CCM combined with Cipher Block Chaining Counter mode (CBC-CTR) and Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity. **Both:** When both TKIP and CCMP are selected, both TKIP and AES clients can associate with the access point. Client stations configured to use WPA with RADIUS must have one of the following to be able to associate with the AP: • A valid TKIP RADIUS IP address and valid shared Key • A valid CCMP (AES) IP address and valid shared Key Clients not configured to use WPA with RADIUS will not be able to associate with AP. By default both TKIP and CCMP are selected. When both TKIP and CCMP are selected, client stations configured to use WPA with RADIUS must have one of the following: • A valid TKIP RADIUS IP address and RADIUS Key • A valid CCMP (AES) IP address and RADIUS Key

Field	Description
Use internal radius server	You can choose whether to use the built-in authentication server provided with the AT-TQ2403 Management Software, or you can use an external radius server. • To use the authentication server provided with the AT-TQ2403 Management Software, ensure the checkbox beside the **Use internal radius server** field is selected. If this option is selected, you do not have to provide the Radius IP and Radius Key; they are automatically provided. If the option for the internal RADIUS server is enabled, configure user accounts on the AP via the **User Management** tab. For more information, see "Managing User Accounts". • To use an external authentication server, ensure the checkbox beside the **Use internal radius server** field is deselected. If you deselect this checkbox you must supply a Radius IP and Radius Key of the server you want to use. **Note:** The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides. On the current release of the AT-TQ2403 Management Software, the RADIUS server User Datagram Protocol (UDP) ports used by the access point are not configurable. (The AT-TQ2403 Management Software is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.
Radius IP	Enter the Radius IP in the text box. The Radius IP is the IP address of the RADIUS server. (The AT-TQ2403 Management Software internal authentication server is **127.0.0.1**) For information on setting up user accounts, see "Managing User Accounts".
Radius Port	Enter the Radius Port in the text box. The Radius Port is the port number of the RADIUS server. (The port of AT-TQ2403 internal RADIUS server is **1812**.)
Radius Key	Enter the Radius Key in the text box. The Radius Key is the shared secret key for the RADIUS server. The text you enter will be displayed as " * " characters to prevent others from seeing the RADIUS key as you type. (The AT-TQ2403 Management Software internal authentication server key is secret. This value is never sent over the network.) Radius Key is a string of up to 128 characters.
Enable RADIUS Accounting	Click **Enable RADIUS Accounting** if you want to enforce authentication for WPA client stations with user names and passwords for each station. See also "Managing User Accounts".

Field	Description
Require VLAN ID in Dynamic VLAN	Dynamic mode is **enabled** when you click the checkbox. If you have enabled dynamic mode and try to establish wireless connection between wireless client and AP, the AP must receive VLAN ID information from Radius server in authentication process. Otherwise, the AP will reject wireless connection to the wireless client. The default setting is unchecked the checkbox, which means dynamic mode is disable.

Updating Settings

To update Security settings:

1. Navigate to the **Security** tab page.
2. Configure the security settings as required.
3. Click the **Update** button to apply the changes.

Chapter 10: Maintenance and Monitoring

The maintenance and monitoring tasks described here all pertain to viewing and modifying settings on specific access points; not on a cluster configuration that is automatically shared by multiple access points. Therefore, it is important to ensure that you are accessing the Administration Web pages for the particular access point you want to configure. For information on this, see "Navigating to Configuration Information for a Specific AP and Managing Standalone APs". The following maintenance and monitoring topics are covered.

- Interfaces
- Ethernet (Wired) Settings
- Wireless Settings
- Event Logs
- Enabling or Disabling Persistence
- Log Relay Host for Kernel Messages
- Transmit/Receive Statistics
- Associated Wireless Clients
- Neighboring Access Points

Interfaces

To monitor wired LAN and wireless LAN (WLAN) settings, navigate to **Status > Interfaces** on the access point you want to monitor.

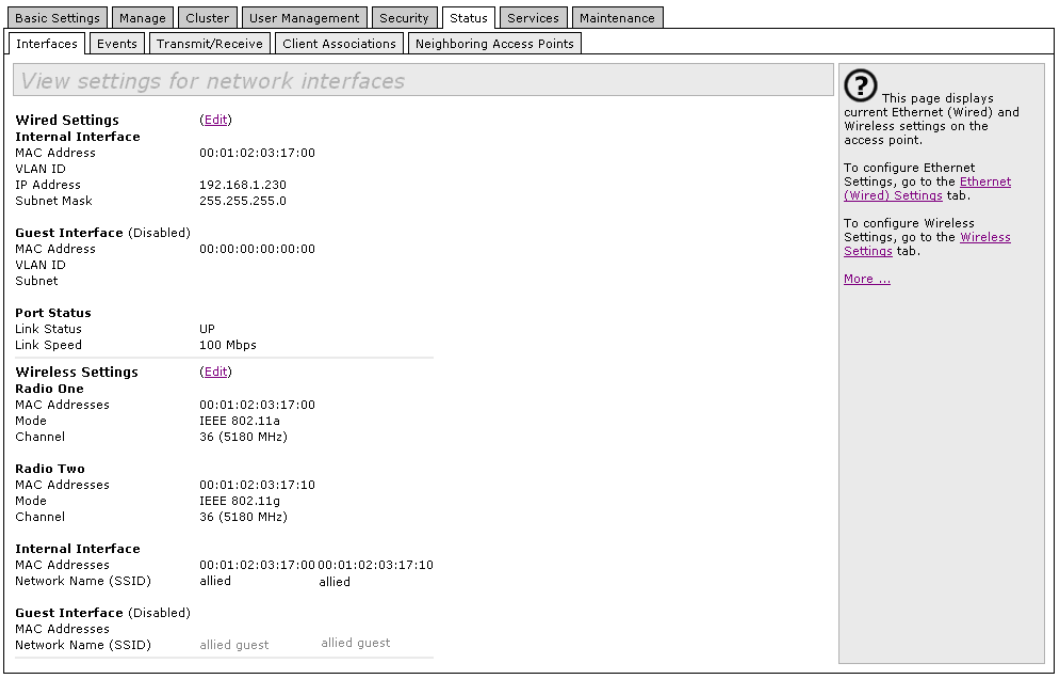


Figure 31: Status - Interfaces Page

This page displays the current settings of the AT-TQ2403 Management Software. It displays the Ethernet (Wired) Settings and the Wireless Settings.

Ethernet (Wired) Settings

The Internal interface includes the Ethernet MAC Address, IP Address, Subnet Mask, and Associated Network Wireless Name (SSID).

The Guest interface includes the MAC Address, VLAN ID, and Associated Network Wireless Name (SSID).

The Port Status includes the Link Status and Link Speed in the Wire Internal Interface.

If you want to change any of these settings, click the **Edit** link.

Wireless Settings

The Radio Interface includes the Radio Mode and Channel. Also shown here are MAC addresses (read-only) and Network Names for the internal and guest interfaces. (See "Setting the Wireless Interface" and "Configuring Radio Settings" for more information.)

If you want to change any of these settings, click the **Edit** link.

Event Logs

To view system events and kernel log for a particular access point, navigate to **Status > Events** on the Administration Web pages for the access point you want to monitor.

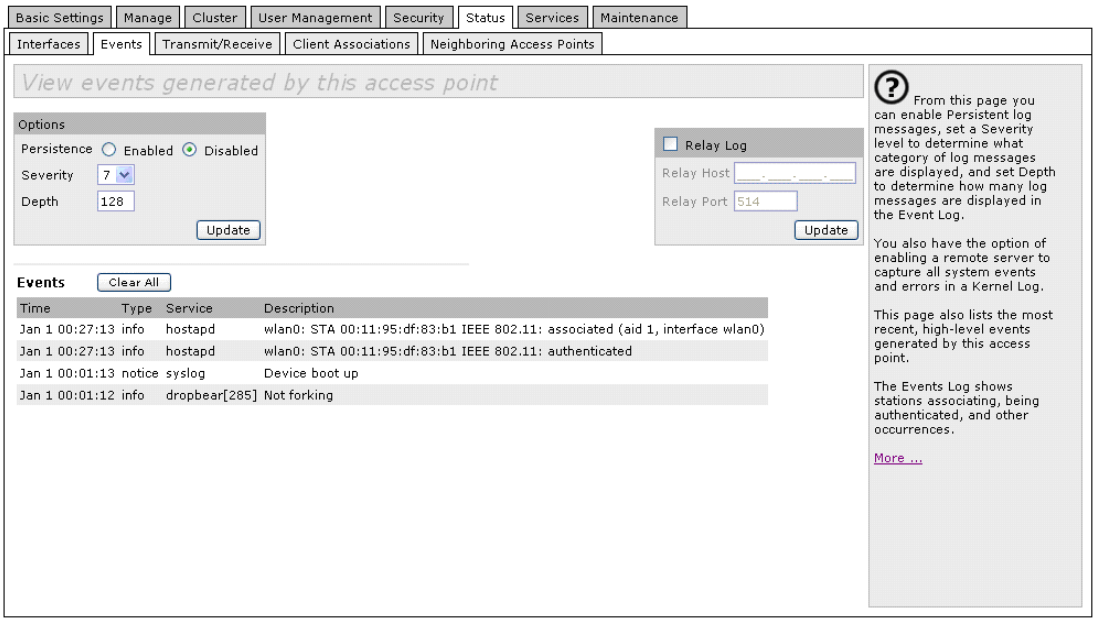


Figure 32: Status - Event Page

The Events tabbed page allows you to enable or disable **Persistence**. This page also gives you the option of enabling a remote "log relay host" to capture all system events and errors in a Kernel Log. (This requires setting up a remote relay host first. See "Log Relay Host for Kernel Messages"). The Events tabbed page also lists the most recent events generated by this access point.

Note: The AT-TQ2403 Management Software acquires its date and time information using the network time protocol (NTP). This data is reported in UTC format (also known as Greenwich Mean Time). You need to convert the reported time to your local time. For information on setting the network time protocol, see "Enabling the Network Time Protocol Server".

Enabling or Disabling Persistence

Persistence can be enabled or disabled from the Events tabbed page. The persistent log is saved in NVRAM. Even after a reboot, all persistent logs are still reserved in NVRAM. Non-persistent logs are only kept during the run-time period. If you reboot the access point, all non-persistent logs will be lost. Enabling Persistence from the **Events** tabbed page ensures that all logs are written to NVRAM and even after a reboot, these are recoverable.

Note: It should be remembered that enabling **Persistence** will result in a continuous write operation. There is a risk that this will wear out the Flash element of the AP. You should decide whether enabling **Persistence** is right for your needs, given the elevated risk of wearing out the flash of the AP.

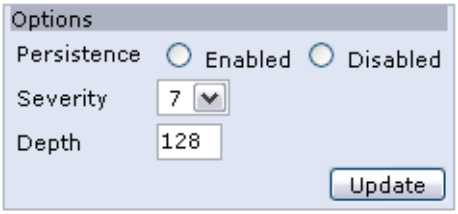


Figure 33: Persistence Setting Detail

Field	Description
Persistence	Choose to either enable or disable Persistence.
Severity	You can choose a Severity level of between 0 and 7. Severity 7 is the least severe level and Severity 0 is the most severe level. For more details on Severity Levels, see "Severity".
Depth	You can enter a value between 1 and 128. For more information on Depth, see "Depth".

Severity

The purpose of severity configuration is to filter or limit the security messages that are displayed in the Event log. It is unlikely that you will want to see a list of all messages. Those of less severity or significance can be filtered using the Severity Configuration feature.

If you set the Severity level to 7, all messages with a severity level between 7 and 0 will appear in the Event log. Alternatively, if you want to filter messages, you can set the Severity level to 4. In this instance,

all messages with a severity level between 4 and 0 will appear in the Event log. Therefore, less severe messages and notices will be ignored.

Severity Level	Description
0	**Emergency**: system is unusable
1	**Alert**: action must be taken immediately
2	**Critical**: critical condition
3	**Error**: error condition
4	**Warning**: warning conditions
5	**Notice**: normal but significant condition
6	**Informational**: information messages
7	**Debug**: debug-level messages

Depth

The value specified in the Depth field determines the number of log entries that can be saved to NVRAM. You can save up to a maximum of 128 entries. If you rely on log messages for monitoring the performance of your AP, you should set the Depth value to the maximum of 128.

Log Relay Host for Kernel Messages

- Understanding Remote Logging
- Setting Up the Log Relay Host
- Enabling or Disabling the Log Relay Host on the **Status > Events** Page

Understanding Remote Logging

The Kernel Log is a comprehensive list of system events (shown in the System Log) and kernel messages such as error conditions like dropping frames.

You cannot view Kernel Log messages directly from the Administration Web UI for an access point. You must first set up a remote server running a syslog process and acting as a syslog "log relay host" on your network. Then, you can configure the AT-TQ2403 Management Software to send its syslog messages to the remote server.

Using a remote server to collect access point syslog messages affords you several benefits. You can:

- Aggregate syslog messages from multiple access points
- Store a longer history of messages than kept on a single access point
- Trigger scripted management operations and alerts

Setting Up the Log Relay Host

To use Kernel Log relaying, you must configure a remote server to receive the syslog messages. This procedure will vary depending on the type of machine you use as the remote log host. Following is an example of how to configure a remote Linux server using the syslog daemon.

> **Note:** The syslog process will default to use port 514. We recommend keeping this default port. However; If you choose to reconfigure the log port, make sure that the port number you assign to syslog is not being used by another process.

Enabling or Disabling the Log Relay Host on the Status > Events Page

To enable and configure Log Relaying on the **Status > Events** page, set the Log Relay options as described below and then click **Update**.

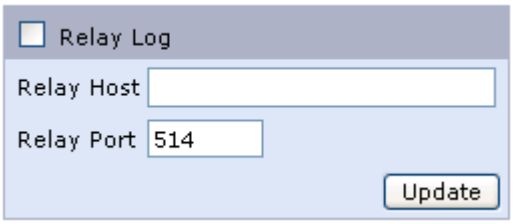


Figure 34: Relay Log Host Setting Detail

Field	Description
Relay Log	Choose to either enable of disable the use of the Log Relay Host. If you select the Relay Log checkbox, the Log Relay Host is enabled and the Relay Host and Relay Port fields are editable.
Relay Host	Specify the IP Address of the Relay Host. **Note**: If you are using AT-TQ2403 Wireless Operations Center, the Repository Server should receive the syslog messages from all access points. In this case, use the IP address of the Operations Venter Repository Server as the Relay Host.
Relay Port	Specify the Port number for the syslog process on the Relay Host. The default port is 514.

Update Settings

To apply your changes, click **Update**.

If you enabled the Log Relay Host, clicking **Update** will activate remote logging. The access point will send its kernel messages real-time for display to the remote log server monitor, a specified kernel log file, or other storage, depending on how you configured the Log Relay Host.

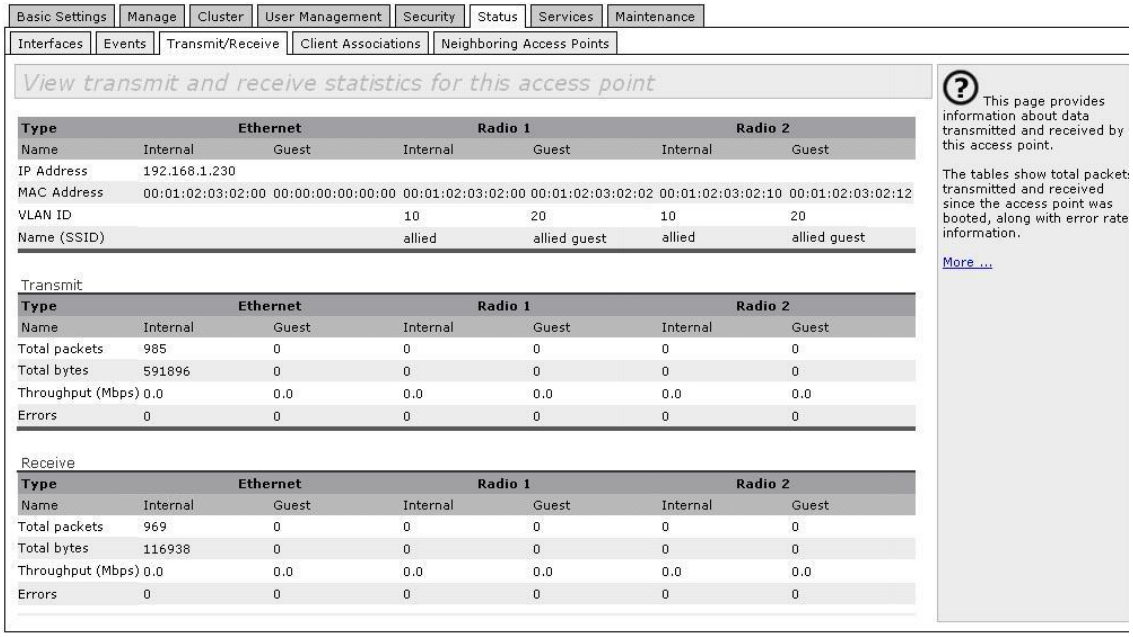
If you disabled the Log Relay Host, clicking **Update** will disable remote logging.

Events Log

The Events Log shows system events on the access point such as stations associating, being authenticated, and other occurrences. The real-time Events Log is always shown on the **Status > Events** Administration Web UI page for the access point you are monitoring. To clear all currently listed events, click **Clear All**.

Transmit/Receive Statistics

To view transmit/receive statistics for a particular access point, navigate to **Status > Transmit/Receive** on the Administration Web pages for the access point you want to monitor.



Type	Ethernet		Radio 1		Radio 2	
Name	Internal	Guest	Internal	Guest	Internal	Guest
IP Address	192.168.1.230					
MAC Address	00:01:02:03:02:00	00:00:00:00:00:00	00:01:02:03:02:00	00:01:02:03:02:02	00:01:02:03:02:10	00:01:02:03:02:12
VLAN ID			10	20	10	20
Name (SSID)			allied	allied guest	allied	allied guest

Transmit

Type	Ethernet		Radio 1		Radio 2	
Name	Internal	Guest	Internal	Guest	Internal	Guest
Total packets	985	0	0	0	0	0
Total bytes	591896	0	0	0	0	0
Throughput (Mbps)	0.0	0.0	0.0	0.0	0.0	0.0
Errors	0	0	0	0	0	0

Receive

Type	Ethernet		Radio 1		Radio 2	
Name	Internal	Guest	Internal	Guest	Internal	Guest
Total packets	969	0	0	0	0	0
Total bytes	116938	0	0	0	0	0
Throughput (Mbps)	0.0	0.0	0.0	0.0	0.0	0.0
Errors	0	0	0	0	0	0

Figure 35: Transmit / Receive Page

This page provides some basic information about the current access point and a real-time display of the transmit and receive statistics for this access point as described in the following table. All transmit and receive statistics shown are totals since the access point was last started. If the AP is rebooted, these figures indicate transmit/receive totals since the re-boot.

Note: These figures do not include traffic from the WDS links.

Field	Description
IP Address	IP Address for the access point.
MAC Address	Media Access Control (MAC) address for the specified interface. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. The AT-TQ2403 has a unique MAC address for each interface and has a different MAC address for each interface on each of its two radios.
VLAN ID	Virtual LAN (VLAN) ID. A VLAN is a software-based, logical grouping of devices on a network that allow them to act as if they are connected to a single physical network, even though they may not be. VLANs can be used to establish internal and guest networks on the same access point.
Name (SSID)	Wireless network name. Also known as the SSID, this alphanumeric key uniquely identifies a wireless local area network. The SSID is set on the Basic Settings tab. (See "Provide Network Settings".)

Transmit and Receive Information

Field	Description
Total Packets	Indicates total packets sent (in Transmit table) or received (in Received table) by this access point.
Total Bytes	Indicates total bytes sent (in Transmit table) or received (in Received table) by this access point.
Throughput	Indicates total Mega bits sent (in Transmit table) or received (in Received table) by this access point during the last one second.
Errors	Indicates total errors related to sending and receiving data on this access point.

Associated Wireless Clients

To view the client stations associated with a particular access point, navigate to **Status > Client Associations** on the Administration Web pages for the access point you want to monitor.

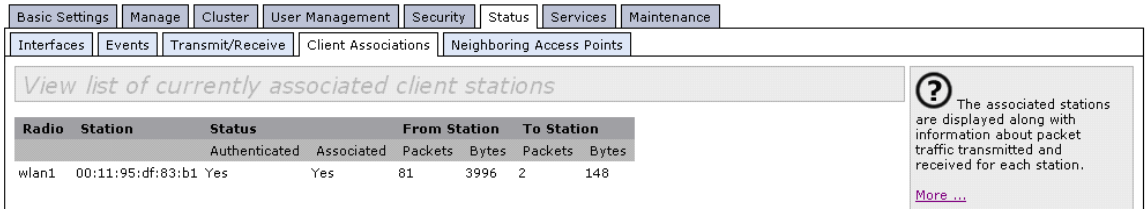


Figure 36: Client Associations Page

The associated stations are displayed along with information about packet traffic transmitted and received for each station.

Note: The **Authenticated** and **Associated** Status shows only the underlying IEEE 802.11 authentication/association, which will be present in all Security modes. It does not refer to or show IEEE 802.1x authentication/association. Some points to keep in mind with regard to this are:

- If the AP is running in Unencrypted ("Plain-text") mode or Static WEP mode, the authentication and association status of clients showing on the Client Associations tab will be in line with what is expected; that is, if a client shows as authenticated to the AP, it will be. (This is because Static WEP uses only IEEE 802.11 authentication.)
- If the AP is running in IEEE 802.1x mode, however, it is possible for a client association to show on this tab as authenticated (via the IEEE 802.11 security) but actually not be authenticated to the AP via the second layer of IEEE 802.1x security .

Link Integrity Monitoring

The AT-TQ2403 Management Software provides link integrity monitoring to continually verify its connection to each associated client (even when there is no data exchange occurring). To do this, the AP sends data packets to clients every few seconds when no other traffic is passing. This allows the access point to detect when a client goes out of range, even during periods when no normal traffic is exchanged. The client connection drops off the list of associated clients within 300 seconds of a client disappearing, even if they do not disassociate (but went out of range).

Neighboring Access Points

The status page of **Neighboring Access Points** provides real-time statistics for all access points within range of the access point on which you are viewing the Administration Web pages.

To view information about other access points on the wireless network, navigate to **Status > Neighboring Access Points**.

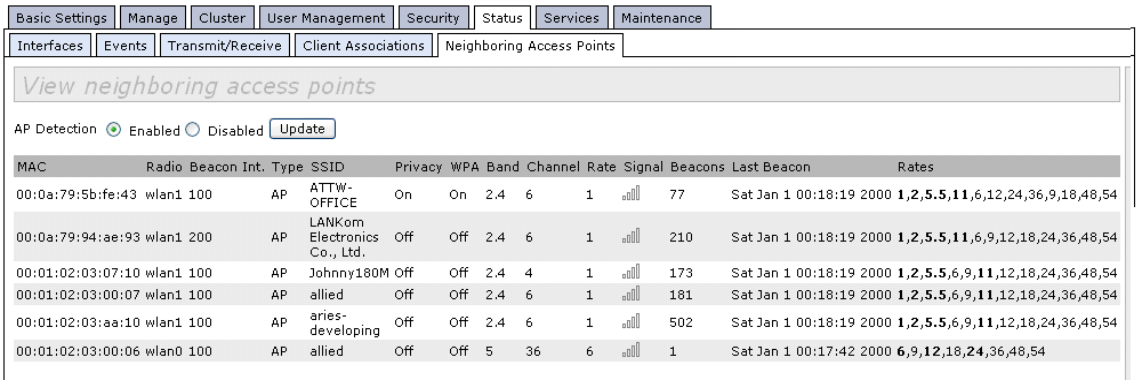


Figure 37: Neighboring Access Points Page

Information provided on neighboring access points is described in the following table.

Field	Description
MAC Address	Shows the MAC address of the neighboring access point. A MAC address is a hardware address that uniquely identifies each node of a network.
Radio	If the access point that is "doing the detecting" of neighboring APs is a two-radio access point, the Radio field is included. The Radio field indicates which radio the neighboring AP was detected on: • wlan0 (Radio One) • wlan1 (Radio Two)
Beacon Interval	Shows the Beacon interval being used by this access point. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second). The Beacon Interval is set on the **Manage > Radio** tab page. (See "Configuring Radio Settings".)
Type	Indicates the type of device: **AP:** It indicates the neighboring device is an access point that supports the IEEE 802.11 Wireless Networking Framework in Infrastructure Mode. **Ad hoc:** It indicates a neighboring station running in Ad hoc Mode. Stations set to ad hoc mode communicate with each other directly, without the use of a traditional access point. Ad-hoc mode is an IEEE 802.11 Wireless Networking Framework also referred to as peer-to-peer mode or an Independent Basic Service Set (IBSS).
SSID	The Service Set Identifier (SSID) for the access point. A Guest network and an Internal network running on the same access point must always have two different network names.
Privacy	Indicates whether there is any security on the neighboring device. • **Off** indicates that the Security mode on the neighboring device is set to "None" (no security). • **On** indicates that the neighboring device has some security in place. Security is configured on the AP from the Security tab page. For more information on security settings, see "Configuring Security".
WPA	Indicates whether WPA security is "on" or "off" for this access point.

Field	Description
Band	This indicates the IEEE 802.11 mode being used on this access point. (For example, IEEE 802.11a, IEEE 802.11b, IEEE 802.11g.) The number shown indicates the mode according to the following map: • 2.4 indicates IEEE 802.11b mode or IEEE 802.11g mode • 5 indicates IEEE 802.11a mode • 5 Turbo indicates Atheros Turbo 5 GHz mode
Channel	Shows the channel on which the access point is currently broadcasting. The Channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving. The channel is set in Radio Settings. (See "Configuring Radio Settings".)
Rate	Shows the rate (in megabits per second) at which this access point is currently transmitting. The current rate will always be one of the rates shown in Supported Rates.
Signal	Indicates the strength of the radio signal received from this access point. According to the strength, show as an icon with 1~4 bars.
# of Beacons	Shows the total number of beacons transmitted by this access point since it was last booted.
Last Beacon	Shows the date and time of the most recent beacon that was transmitted from the access point.
Rates	Shows supported and basic (advertised) rate sets for the neighboring access point. Rates are shown in megabits per second (Mbps). All Supported Rates are listed, with Basic Rates shown in bold. Rate sets are configured on Radio Settings. (See "Configuring Radio Settings".) The rates shown for an access point will always be the rates currently specified for that AP in its Radio Settings.

Chapter 11: Setting the Ethernet (Wired) Interface

Ethernet (Wired) Settings describe the configuration of your Ethernet local area network (LAN).

Note: The Ethernet Settings, including guest access, are not shared across the cluster. These settings must be configured individually on the Administration pages for each access point. To get to the Administration pages for an access point that is a member of the current cluster, click on its IP Address link on the **Cluster** > **Access Points** page of the current AP. For more information about which settings are shared by the cluster and which are not, see "Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?"

The following sections describe how to configure "Wired" address and related settings on the AT-TQ2403 Management Software:

- Navigating to Ethernet (Wired) Settings
- Setting the DNS HostName
- Enabling or Disabling Guest Access
  - Configuring an Internal LAN and a Guest Network
  - Enabling or Disabling Guest Access and Choosing a Virtual Network
- Enabling or Disabling Virtual Wireless Networks on the AP
- Enabling or Disabling Standby Power Saving
- Configuring LAN or Internal Interface Ethernet Settings
- Configuring Guest Interface Ethernet (Wired) Settings
- Updating Settings

Navigating to Ethernet (Wired) Settings

To set the wired address for an access point, navigate to the **Manage > Ethernet Settings** tab, and update the fields as described below.

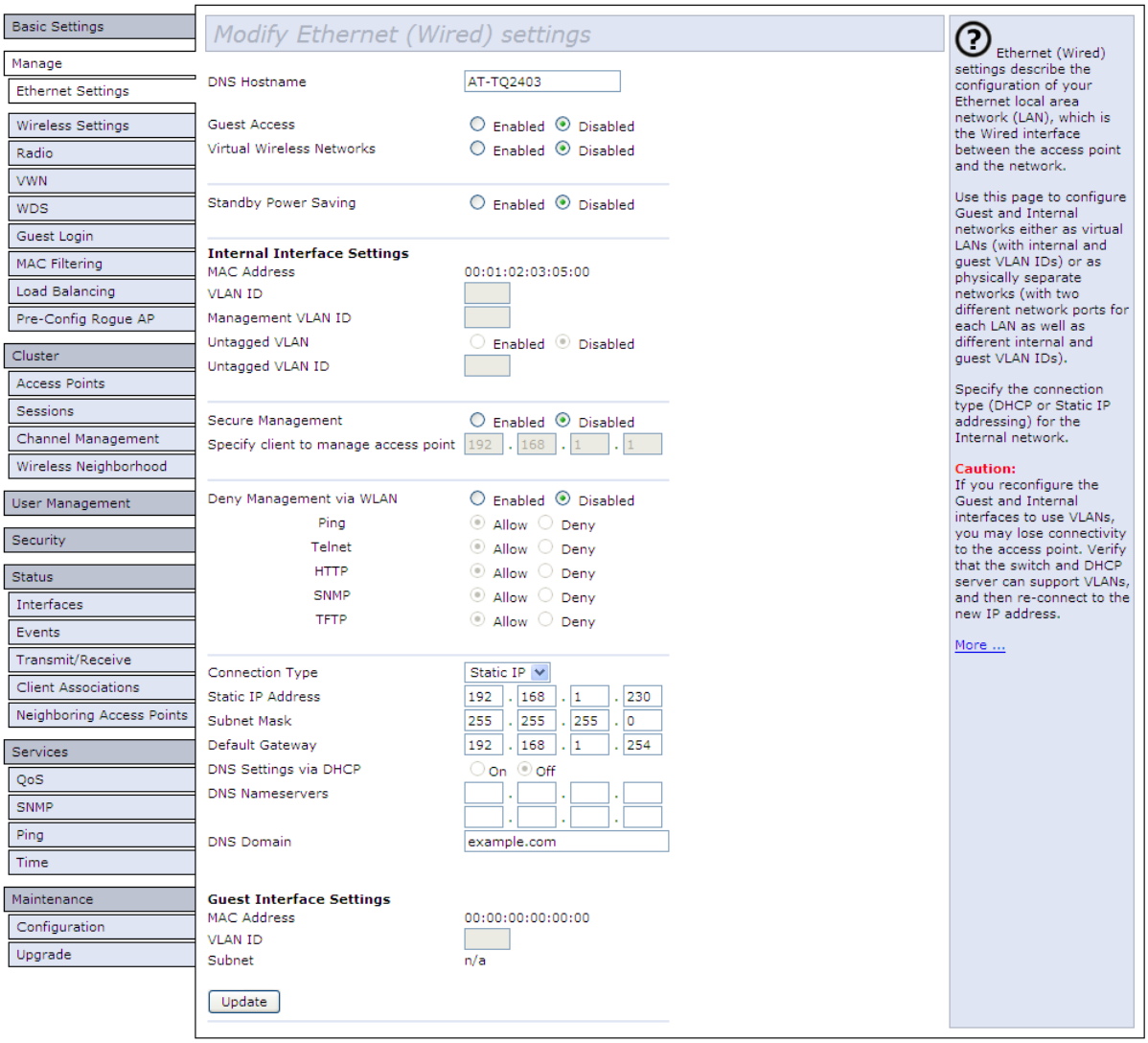


Figure 38: Ethernet (Wired) Settings Page

Setting the DNS HostName

Field	Description
DNS Hostname	Enter the DNS name for the access point in the text box. This is the host name. It may be provided by your ISP or network administrator, or you can provide your own. The rules for system names are: • This name can be up to 20 characters long. • Only letters, numbers and hyphens are allowed. • No hyphens can be used at the beginning or end of the DNS name.

Enabling or Disabling Guest Access

You can provide controlled guest access over an isolated network and a secure internal LAN on the same AT-TQ2403 Management Software.

Configuring an Internal LAN and a Guest Network

A Local Area Network (LAN) is a communications network covering a limited area, for example, one floor of a building. A LAN connects multiple computers and other network devices like storage and printers.

Ethernet is the most common technology implementing a LAN. Wi-Fi (IEEE) is another very popular LAN technology.

The AT-TQ2403 Management Software allows you to configure two different LANs on the same access point: one for a secure internal LAN and another for a public *guest* network with no security and little or no access to internal resources. To configure these networks, you need to provide both Wireless and Ethernet (Wired) settings.

Information on how to configure the Ethernet (Wired) settings is provided in the sections below.

(For information on how to configure the Wireless settings, see "Setting the Wireless Interface". For an overview of how to set up the Guest interface, see "Setting up Guest Access".)

Enabling or Disabling Guest Access and Choosing a Virtual Network

If you want to provide guest access on your AP, enable **Guest Access** on the **Ethernet (Wired) Settings** tab. If you enable **Guest Access**, you must choose a method of representing both an **Internal** and **Guest Network** on this access point. There is one way of doing this: virtually, by connecting the LAN port on the access point to a tagged port on a VLAN capable switch and then defining two different Virtual LANs on this Administration page. (For more information, see "Setting up Guest Access".)

Choose virtually separate internal and guest LANs as described below.

Field	Description
Guest Access	The AT-TQ2403 ships with the Guest Access feature disabled by default. You can: • Select **Enabled** to enable Guest Access. • Select **Disabled** to disable Guest Access

Enabling or Disabling Virtual Wireless Networks on the AP

If you want to configure the Internal network as a VLAN (whether or not you have a Guest network configured), you can enable "Virtual Wireless Networks" on the access point. You must enable this feature if you want to configure additional virtual networks on VLANs on the **Manage > VWN** tab as described in "Configuring Virtual Wireless Networks".

Field	Description
Virtual Wireless Networks	• Select **Enabled** to enable VLANs for the Internal network and for additional networks. (If you choose this option, you can run the Internal network on a VLAN whether or not you have Guest Access configured and you can set up additional networks on VLANs using the **Manage > VWN** tab as described in "Configuring Virtual Wireless Networks".) • Select **Disabled** to disable the VLAN for the Internal network, and for any additional virtual networks on this access point.

Enabling or Disabling Standby Power Saving

If you want to save as much power consumption as possible, you can enable **Standby Power Saving** on the **Ethernet (Wired) Settings** tab. If you enable **Standby Power Saving,** the access point watches the link status on its Ethernet port. When the link status become down, the access point suspends all the communication functions then wait for the link status come up.

Note:

- This function operates only when the power supply is supplied by the AC adapter.
- If enables it may take one or two minutes to resume the communication functions after the link status become up.
- When WDS is enabled, or the statuses of both two radios are OFF, the setting of this function will be ignored.
- When this function is enabled, the setting of the link relay will be ignored.

Field	Description
Standby Power Saving	• Select **Enabled** to enable Standby Power Saving. • Select **Disabled** to enable Standby Power Saving.

Configuring LAN or Internal Interface Ethernet Settings

To configure Ethernet (Wired) settings for the Internal LAN, fill in the fields as described below.

Field	Description
MAC Address	Shows the MAC address for the Internal interface for the Ethernet port on this access point. This is a read-only field that you cannot change.

Field	Description
VLAN ID	If you have enabled VWNs or Guest access via VLAN, this field will be enabled. Provide a number between 1 and 4094 for the Internal VLAN. This VLAN ID must not be the same as the Guest VLAN ID or a VWN VLAN ID. Check with the Network Administrator regarding the VLAN and DHCP configurations.
Management VLAN ID	If you have enabled VWNs or Guest access via VLAN, this field will be enabled. Enter a value for the Management VLAN ID. This ID can be any value between 1 and 4094. The Management VLAN ID enables you to specify the VLAN used for managing the AP. You can then manage the AP via the Web User Interface, the Command Line Interface, and SNMP using this VLAN. If the Connection Type is set to DHCP, this will cause the access point to send DHCP requests with the VLAN tag. The switch and the DHCP server must support VLAN IEEE802.1Q frames. The access point must be able to reach the DHCP server. There are no restrictions on the Management VLAN ID you specify. The Management VLAN ID can be the same as the Internal VLAN ID, the Guest VLAN ID, a VWN VLAN ID, or the Untagged VLAN ID.
Untagged VLAN	If you have enabled VWNs or Guest access via VLAN, you can enable or disable untagged VLANs. • Select **Enabled** to enable Untagged VLAN • Select **Disabled** to disable Untagged VLAN If Untagged VLAN is enabled, then any packets received without a VLAN tag will be treated as if they were received with the specified Untagged VLAN ID. If Untagged VLAN is disabled, then any packets received without a VLAN tag are bridged to WDS links, but not otherwise used by the AP.
Untagged VLAN ID	If you have enabled Untagged VLAN, this field will be enabled. Enter a value for the Untagged VLAN ID. This can be any value between 1 and 4094. There are no restrictions on the Untagged VLAN ID you specify. The Untagged VLAN ID can be the same as the Internal VLAN ID, the Guest VLAN ID, a VWN VLAN ID, or the Management VLAN ID.

Field	Description
Secure Management	You can restrict access to management IP interface to the specified client. Select **Enabled** to enable Secure Management feature. Only the specified client can access the management IP interface (Web pages, telnet) of this access point. Select **Disabled** to disable Secure Management feature. Anyone can access the management IP interface of this access point.
Specify client to manage access point	If you enable **Secure Management**, you have to enter the IP address in the text boxes. Only this specified client can access the management IP interface of this access point.
Deny Management via WLAN	You can prohibit wireless clients from accessing the management IP interface. Select **Enabled** to restrict the management access of WLAN clients. Only clients on LAN can access the management IP interface of this access point. Select **Disabled** to disable the restriction of management access to WLAN. The prohibited accesses include Ping, Web, Telnet, SNMP and TFTP.
Ping / Telnet / HTTP / SNMP / TFTP	If you enable **Deny Management via WLAN**, these fields will be configurable. For Ping/Telnet/HTTP/SNMP/TFTP, you can allow or deny the wireless clients to access these applications on the device individually.
Connection Type	You can select **DHCP** or **Static IP**. **DHCP:** The Dynamic Host Configuration Protocol (DHCP) is a protocol specifying how a centralized server can provide network configuration information to devices on the network. A DHCP server "offers" a "lease" to the client system. The information supplied includes the IP addresses and netmask plus the address of its DNS servers and gateway. **Static IP:** It indicates that all network settings are provided manually. You must provide the IP address for the AT-TQ2403 Management Software, its subnet mask, the IP address of the default gateway, and the IP address of at least one DNS Nameserver. If you select "DHCP", the AT-TQ2403 Management Software will acquire its IP Address, subnet mask, and DNS and gateway information from the DHCP Servers. Otherwise, if you select "Static IP", fill in the following items. **Caution:** When you change the Connection Type to Static IP, you can either assign a new Static IP Address to the AP or continue using the default address. We recommend assigning a new address so that if later you bring up another AT-TQ2403 Management Software on the same network, the IP addresses for the two APs will be unique.

Field	Description
Static IP Address	If you chose **Static IP** as the Connection Type, these fields will be enabled. Enter the Static IP Address in the text boxes.
Subnet Mask	Enter the **Subnet Mask** in the text boxes. You must obtain this information from your ISP or network administrator.
Default Gateway	Enter the **Default Gateway** in the text boxes.
DNS Nameservers	The Domain Name Service (DNS) is a system that resolves the descriptive name (domainname) of a network resource (for example, **www.alliedtelesis.com**) to its numeric IP address (for example, **66.93.138.219**). A DNS server is called a Nameserver. There are usually two Nameservers; a Primary Nameserver and a Secondary Nameserver. You can choose **DNS Settings via DHCP:** • If you choose **On**, the IP addresses for the DNS servers will be assigned automatically via DHCP. (This option is only available if you specified DHCP for the Connection Type). • If you choose **Off**, you should assign static IP addresses manually.
DNS Domain	Specifies a local domain name for use as the default domain. The DNS Domain can be up to 63 characters long.

Configuring Guest Interface Ethernet (Wired) Settings

To configure Ethernet (Wired) Settings for the "Guest" interface, fill in the fields as described below.

Field	Description
MAC Address	Shows the MAC address for the Guest interface for the Ethernet port on this access point. This is a read-only field that you cannot change.
VLAN ID	If you choose to configure Internal and Guest networks by "VLANs", this field will be enabled. (Provide a number between 1 and 4094 for the Guest VLAN.)
Subnet	Shows the subnet work address for the Guest interface. For example, **192.168.1.0**.

Updating Settings

To update Ethernet settings:

1. Navigate to the **Ethernet (Wired) Settings** page.
2. Configure the Ethernet settings as required.
3. Click the **Update** button to apply the changes.

Chapter 12: Setting the Wireless Interface

Wireless settings describe aspects of the local area network (LAN) related specifically to the radio device in the access point (802.11 Mode and Channel) and to the network interface to the access point (MAC address for access point and Wireless Network name, also known as SSID). The following sections describe how to configure the "Wireless" address and related settings on the AT-TQ2403 Management Software:

- Navigating to Wireless Settings
- Configuring 802.11d Regulatory Domain Support
- 802.11h Regulatory Domain Control
- Configuring the Radio Interface
- Configuring "Internal" LAN Wireless Settings
- Configuring "Guest" Network Wireless Settings
- Updating Settings

Navigating to Wireless Settings

To set the wireless address for an access point, navigate to the **Manage > Wireless Settings** tab, and update the fields as described below.

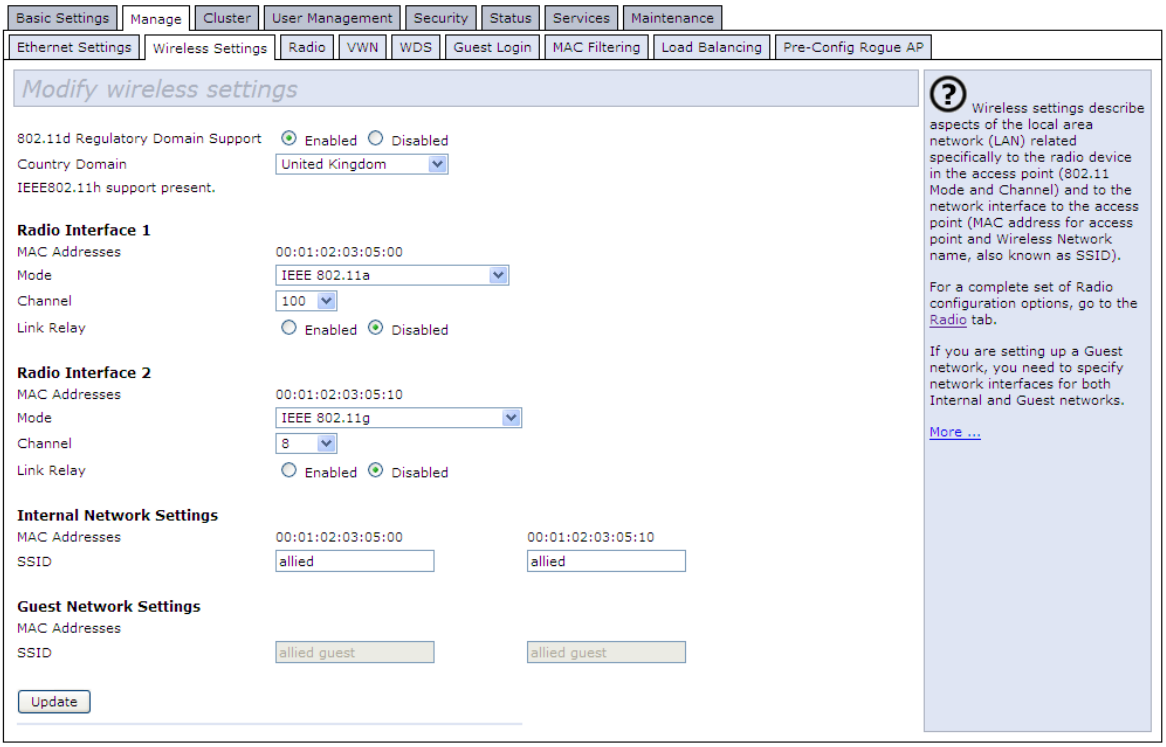


Figure 39: Wireless Settings Page

Configuring 802.11d Regulatory Domain Support

You can enable or disable IEEE 802.11d Regulatory Domain Support to broadcast the access point country code information as described below.

Field	Description
802.11d Regulatory Domain Support	Enabling support for IEEE 802.11d on the access point causes the AP to broadcast which country it is operating in as a part of its beacons: • To enable 802.11d regulatory domain support, click **Enabled**. • To disable 802.11d regulatory domain support, click **Disabled**. **Note:** The IEEE 802.11d defines standard rules for the operation of IEEE 802.11 wireless LANs in any country without re-configuration. IEEE 802.11d allows client stations to operate in any country without re-configuration. The AT-TQ2403 Management Software must be configured by the Manufacturer via the command line interface (CLI) country codes for operation in a particular country.
Country Domain	Select the country where this device locates. **Note:** This item will not appear when AT-TQ2403 is sold to specific regions, hence you can not configure this item.

802.11h Regulatory Domain Control

Field	Description
IEEE 802.11h	The Administration UI will show whether IEEE 802.11h regulatory domain control is in effect on the AP. IEEE 802.11h cannot be disabled by an end user Administrator. The following details are provided for informational purposes only. IEEE 802.11h is a standard that provides two services required to satisfy certain regulatory domains for the 5GHz band. These two services are Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS). • TPC requires that Radio Local Area Networks (RLANs) operating in the 5 GHz band use transmitter power control. This involves adhering to a regulatory maximum transmit output power and a mitigation requirement for each permitted channel. The result of which is the reduced interference with satellite services. • DFS requires that RLANs operating in the 5 GHz band implement a mechanism to avoid co-channel operation with radar systems and ensure uniform utilization of any available channels. **Note:** 802.11h is automatically enabled if the AP is configured to work in any country that requires 802.11h as a minimum standard. This standard is currently only required by those countries which fall into the European Telecommunications Standard Institute (ETSI) category. 802.11h is also enabled for Japan.

There are a number of key points for the AP Developer that should be remembered in relation to the IEEE 802.11h standard:

- 802.11h only works for the 802.11a band. It is not required for 802.11b, nor 802.11g

- If you are operating in an 802.11h enabled domain, then the channel selection of the BSS will always be "Auto". Even if another channel has been has been configured, this will be ignored and auto-channel selection will occur.

- When 802.11h is enabled, the initial boot-up time will increase by a minimum of sixty seconds. This is the minimum time required to scan the selected channel for radar interference.

- Setting up WDS links may be difficult when 802.11h is operational. This is because the operating channels of the two APs on the WDS link may keep changing depending on channel usage and radar interference. WDS will only work if both the APs operate on the same channel. For more information on WDS, see "Configuring the Wireless Distribution System (WDS)".

Configuring the Radio Interface

The radio interface allows you to set the radio Channel and 802.11 mode as described below.

Note: You must configure these radio interface settings for both **Radio Interface One** and **Radio Interface Two**.

Field	Description
MAC Addresses	Indicates the Media Access Control (MAC) addresses for the interface. The MAC addresses for Radio Interface One (Internal/Guest) and Radio Interface Two (Internal/Guest) are shown. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface.
Mode	The Mode defines the Physical Layer (PHY) standard being used by the radio. The AT-TQ2403 is dual band access point with two radios. Select one of these modes: a mode for each Radio Interface. For Radio Interface 1 • IEEE 802.11a • Atheros Turbo 5G GHz • Atheros Dynamic Turbo 5G GHz For Radio Interface 2 • IEEE 802.11b • IEEE 802.11g • Atheros Turbo 2.4 GHz • Atheros Dynamic Turbo 2.4 GHz Select an IEEE 802.11 mode for each of the two radio interfaces. **Note:** The turbo function depends on Country Domain and Product model. Not all country and model support the turbo function.

Field	Description
Channel	Select the **Channel**. The range of channels and the default is determined by the Mode of the radio interface. The Channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each mode offers a number of channels, dependent on how the spectrum is licensed by national and trans-national authorities such as the Federal Communications Commission (FCC) or the International Telecommunication Union (ITU-R). If you select a number from the list as the operating channel, due to DFS function (See "802.11h Regulatory Domain Control"), the actual operating channel might be different from your selection. If you want to know the current operation channel, please reference to chapter 10 Maintenance and Monitoring (**status -> Interface**), the value of channel of Wireless Settings.
Link Relay	This item is the settings about Link Relay. The Link Relay is a feature which automatically disables the wireless interface when the link of LAN interfaces is down. • To enable Link Relay, click **Enabled**. • To disable Link Relay, click **Disabled**. **Note:** This function is not operated when WDS bridge is configured.

Configuring "Internal" LAN Wireless Settings

The Internal Settings describe the MAC Address (read-only) and Network Name (also known as the SSID) for the internal Wireless *LAN* (WLAN) as described below.

Field	Description
MAC Address	Shows the MAC address(es) for Internal interface for this access point. This is a read- only field that you cannot change. Although this access is point is physically a single device, it can be represented on the network as two or more nodes each with a unique MAC Address. This is accomplished by using multiple Basic Service Set Identifiers (BSSIDs) for a single access point. The MAC address(es) shown for the "Internal" access point is the BSSID(s) for the "Internal" interface. Two MAC addresses are shown: one for each Radio on the Internal interface.

Field	Description
Wireless Network Name (SSID)	Enter the SSID for the internal WLAN. The Service Set Identifier (SSID) is a string of up to 32 characters that uniquely identifies a wireless local area network. It is also referred to as the Network Name. Two SSIDs are shown: one for each Radio on the Internal interface.

Configuring "Guest" Network Wireless Settings

The Guest Settings describe the MAC Address (read-only) and wireless network name (SSID) for the Guest Network as described below. Configuring an access point with two different network names (SSIDs) allows you to leverage the Guest interface feature on the AT-TQ2403 Management Software. For more information, see "Setting up Guest Access".

Field	Description
MAC Address	Shows the MAC address for the Guest interface for this access point. This is a read- only field that you cannot change. Although this access is point is physically a single device, it can be represented on the network as two or more nodes each with a unique MAC Address. This is accomplished by using multiple Basic Service Set Identifiers (BSSID) for a single access point. The MAC address(es) shown for the "Guest" access point is the BSSID(s) for the "Guest" interface. Two MAC addresses are shown, one for each Radio on the Guest interface.
Wireless Network Name (SSID)	Enter the SSID for the guest network. The Service Set Identifier (SSID) is a string of up to 32 characters that uniquely identifies a wireless local area network. It is also referred to as the Network Name. There are no restrictions on the characters that may be used in an SSID. For the guest network, provide an SSID that is different from the internal SSID and easily identifiable as the "guest" network. Two SSIDs are shown, one for each Radio on the Guest interface.

Updating Settings

To update wireless settings:

1. Navigate to the **Wireless Settings** page.
2. Configure the wireless settings as required.
3. Click the **Update** button to apply the changes.

Chapter 13: Setting up Guest Access

Out-of-the-box *Guest Interface* features allow you to configure the AT-TQ2403 Management Software for controlled guest access to an isolated network. You can configure the same access point to broadcast and function as two different wireless networks: a secure "Internal" LAN and a public "Guest" network.

Guest clients can access the guest network without a username or password. When guests log in, they see a guest Welcome screen (also known as a captive portal).

The following sections are included here:

- Understanding the Guest Interface
- Configuring the Guest Interface
    - Configuring a Guest Network on a Virtual LAN
    - Configuring the Welcome Screen (Captive Portal)
- Using the Guest Network as a Client
- Deployment Example

Understanding the Guest Interface

You can define unique parameters for *guest* connectivity and isolate guest clients from other more sensitive areas of the network. No security is provided on the guest network; only plain-text security mode is allowed.

Simultaneously, you can configure a secure *internal* network (using the same access point as your guest interface) that provides full access to protected information behind a firewall and requires secure login or certificates for access.

You can configure an AT-TQ2403 Management Software for the Guest interface in below way:

- Configure the access point using a single network with VLANs by setting up the guest interface configuration options on the Administration Web pages for the AT-TQ2403 Management Software. (For details on how to set up this type of guest interface, see "Configuring a Guest Network on a Virtual LAN".)

Note:

- The above method leverages multiple BSSID and Virtual LAN (VLAN) technologies that are built-in to the AT-TQ2403 Management Software. The Internal and Guest networks are implemented as multiple BSSIDs on the same access point, each with different network names (SSIDs) on the Wireless interface and different VLAN IDs on the Wired interface.
- The Guest Management and Login settings apply to both Radio One and Radio Two.

Configuring the Guest Interface

To configure the Guest interface on the AT-TQ2403 Management Software, perform these configuration steps:

1. Configure the access point to represent two virtually separate networks as described in the section below, "Configuring a Guest Network on a Virtual LAN".

2. Set up the guest Welcome screen for the guest captive portal as described in the section below, "Configuring the Welcome Screen (Captive Portal)".

Note: Guest Interface settings are not shared among access points across the cluster. These settings must be configured individually on the Administration pages for each access point. To get to the Administration pages for an access point that is a member of the current cluster, click on its IP Address link on the **Cluster > Access Points** page of the current AP. For more information about which settings are shared by the cluster and which are not, see "Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?".

Configuring a Guest Network on a Virtual LAN

Note: If you want to configure the Guest and Internal networks on Virtual LAN (VLANs), the switch and DHCP server you are using must support VLANs.

As a prerequisite step, configure a port on the switch for handling VLAN tagged packets as described in the IEEE 802.1Q standard.

Guest Welcome Screen settings are shared among access points across the cluster. When you update these settings for one access point, the configuration will be shared with the other access points in the cluster. For more information about which settings are shared by the cluster and which are not, see "Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?".

To configure Internal and Guest networks on Virtual LANs, do the following:

1. Use only one wired connection from the network port on the access point to the LAN. (Make sure this port is configured to handle VLAN tagged packets.)

2. Configure Ethernet (wired) Settings for Internal and Guest networks on VLANs as described in the sections in "Setting the Ethernet (Wired) Interface".

   (Start by enabling Guest Access and choosing "For Internal and Guest access, use two: **VLANs**" as described in "Enabling or Disabling Guest Access and Choosing a Virtual Network".)

3. Provide the radio interface settings and network names (SSIDs) for both Internal and Guest networks as described in "Setting the Wireless Interface".

4. Configure the guest splash screen as described in "Configuring the Guest Interface".

Configuring the Welcome Screen (Captive Portal)

You can set up or modify the Welcome screen guest clients see when they open a Web browser or try to browse the Web. To set up the captive portal, do the following.

1. Navigate to the **Manage > Guest Login** tab.

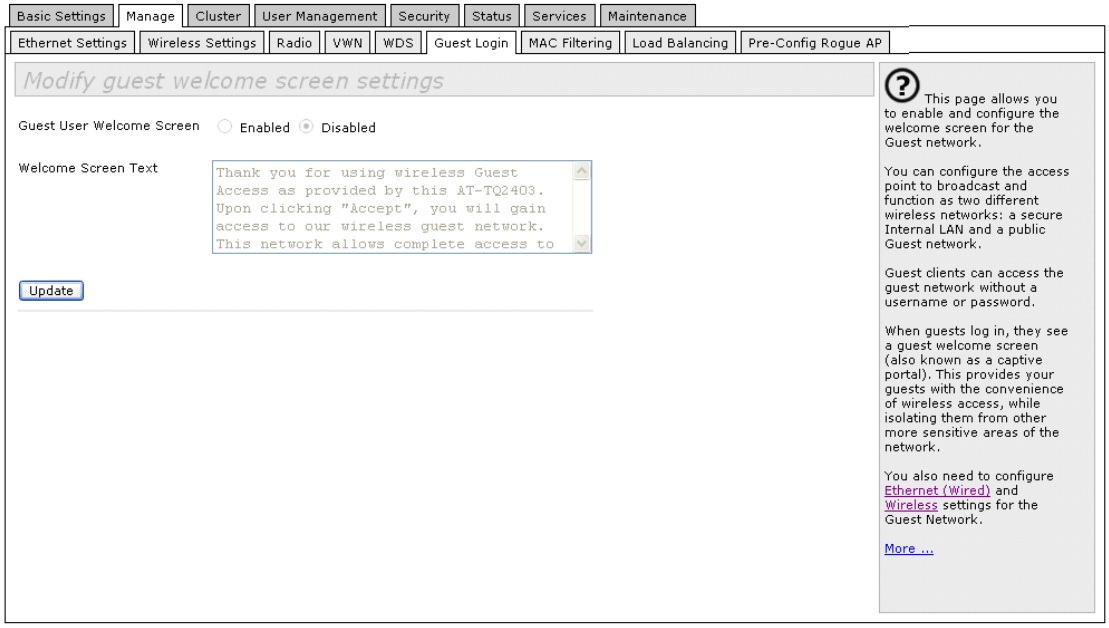


Figure 40: Guest Login Setting Page

2. Choose **Enabled** to activate the Welcome screen.
3. In the Welcome Screen Text field, type the text message you would like guest clients to see on the captive portal. The maximum length of this text is 1,000 characters.
4. Click **Update** to apply the changes.

Using the Guest Network as a Client

Once the guest network is configured, a client can access the guest network as follows:

1. A guest client enters an area of coverage and scans for wireless networks.
2. The guest network advertises itself via a Guest SSID or some similar name, depending on how the guest SSID is specified in the Administration Web pages for the Guest interface.
3. The guest client chooses Guest SSID.
4. The guest client starts a Web browser and receives a Guest Welcome screen.
5. The Guest Welcome Screen provides a button for the client to click to continue.
6. The guest client is now enabled to use the “guest” network

Deployment Example

In the figure below, the dotted red lines indicate dedicated guest connections.

All access points and all connections (including guests) are administered from the same AT-TQ2403 Management Software Administration Web pages.

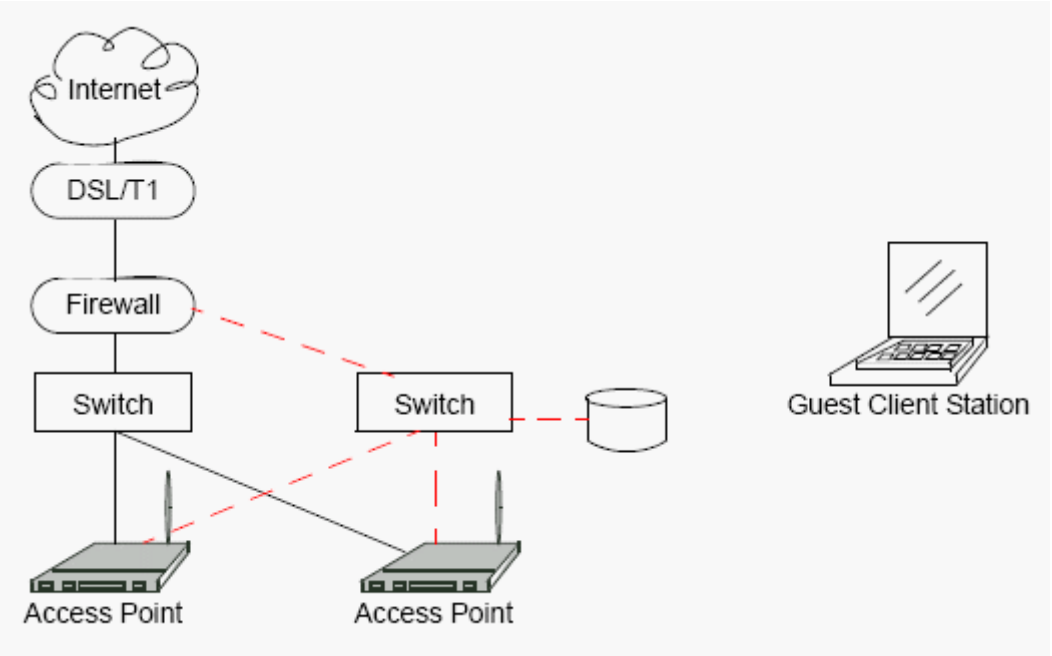


Figure 41: Guest Network Diagram Example

Chapter 14: Configuring Virtual Wireless Networks

The following sections describe how to configure multiple wireless networks on Virtual LANs (VLANs):

- Navigating to Virtual Wireless Network Settings
- Configuring VLANs
- Updating Settings

Navigating to Virtual Wireless Network Settings

To set up multiple networks on VLANs navigate to the **Manage > VWN** tab, and update the fields as described below.

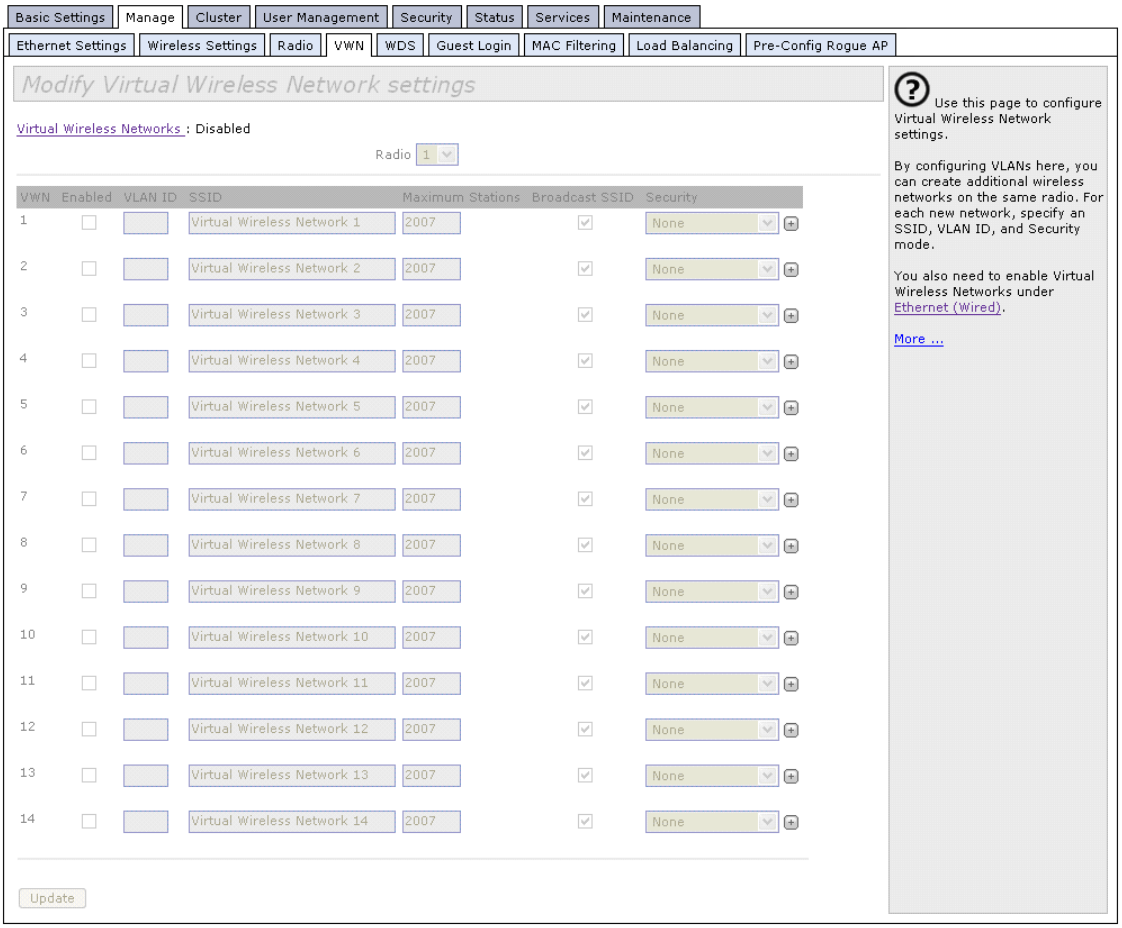


Figure 42: VWN Page

Configuring VLANs

Note:

- To configure additional networks on VLANs, you must first enable Virtual Wireless Networks on the Ethernet Settings page. See "Enabling or Disabling Virtual Wireless Networks on the AP".
- If you configure VLANs, you may lose connectivity to the access point. First, be sure to verify that the switch and DHCP server you are using can support VLANs per the IEEE 802.1Q standard. After configuring VLANs, physically reconnect the Ethernet cable on the switch to the tagged packet (VLAN) port. Then, re-connect via the Administration Web pages to the new IP address. (If necessary, check with the infrastructure support administrator regarding the VLAN and DHCP configurations.)

Field	Description
Virtual Wireless Network	You can configure up to 14 VWNs.
Enabled	You can enable or disable a configured network. • To enable the specified network, check the **Enabled** checkbox beside the appropriate VWN. • To disable the specified network, uncheck the **Enabled** checkbox beside the appropriate VWN. If you disable the specified network, you will lose the VLAN ID you entered.
VLAN ID	Provide a number between 1 and 4094 for the Internal VLAN. This will cause the access point to send DHCP requests with the VLAN tag. The switch and the DHCP server must support VLAN IEEE 802.1Q frames. The access point must be able to reach the DHCP server. Check with the Administrator regarding the VLAN and DHCP configurations.
SSID	Enter a name for the wireless network as a character string. This name will apply to all access points on this network. As you add more access points, they will share this SSID. The *Service Set Identifier* (SSID) is an alphanumeric string of up to 32 characters. **Note:** If you are connected as a wireless client to the same AP that you are administering, resetting the SSID will cause you to lose connectivity to the AP. You will need to reconnect to the new SSID after you save this new setting.

Field	Description
Broadcast SSID	Select the **Broadcast SSID** setting by selecting the **Broadcast SSID** checkbox. By default, the access point broadcasts (allows) the Service Set Identifier (SSID) in its beacon frames. You can suppress (prohibit) this broadcast to discourage stations from automatically discovering your access point. When the AP's broadcast SSID is suppressed, the network name will not be displayed in the List of Available Networks on a client station. Instead, the client must have the exact network name configured in the supplicant before it will be able to connect. **Note:** The Broadcast SSID you set here is specifically for this Virtual Network (One or Two). Other networks continue to use the security modes already configured: • Your original Internal network (configured on **Ethernet (Wired)** tab) uses the Broadcast SSID set on Security. • If a Guest network is configured, the Broadcast SSID is always allowed.
Security Mode	Select the Security Mode for this VLAN. Select one of the following: • None (Plain-text) • Static WEP • IEEE802.1x • WPA Personal • WPA Enterprise **Note:** The Security mode you set here is specifically for this Virtual Network. Other networks continue to use the security modes already configured: • Your original Internal network (configured on Ethernet Settings page) uses the Security mode set on Security. • If a Guest network is configured, always set the security mode to "None".

Updating Settings

To update VLAN settings:

1. Navigate to the **VWN** tab page.
2. Configure the VWN settings as required.
3. Click the **Update** button to apply the changes.

Chapter 15: Configuring Radio Settings

The following sections describe how to configure Radio Settings on the AT-TQ2403 Management Software:

- Understanding Radio Settings
- Navigating to Radio Settings
- Updating Settings

Understanding Radio Settings

Radio settings directly control the behavior of the radio device in the access point and its interaction with the physical medium; that is, how/what type of electromagnetic waves the AP emits. You can specify whether the radio is on or off, radio frequency (RF) broadcast channel, beacon interval (amount of time between AP beacon transmissions), transmit power, IEEE 802.11 mode in which the radio operates, and so on.

The AT-TQ2403 Management Software comes configured as a dual band access point. The access point is capable of broadcasting in the following modes:

- IEEE 802.11b mode
- IEEE 802.11g mode
- IEEE 802.11a mode
- Atheros Turbo 5 GHz
- Atheros Dynamic Turbo 5 GHz
- Atheros Turbo 2.4 GHz
- Atheros Dynamic Turbo 2.4 GHz
- Extended Range

The IEEE mode along with other radio settings are configured as described in "Navigating to Radio Settings" and "Configuring Radio Settings".

Navigating to Radio Settings

To specify radio settings, navigate to **Manage > Radio** tab, and update the fields as described below.

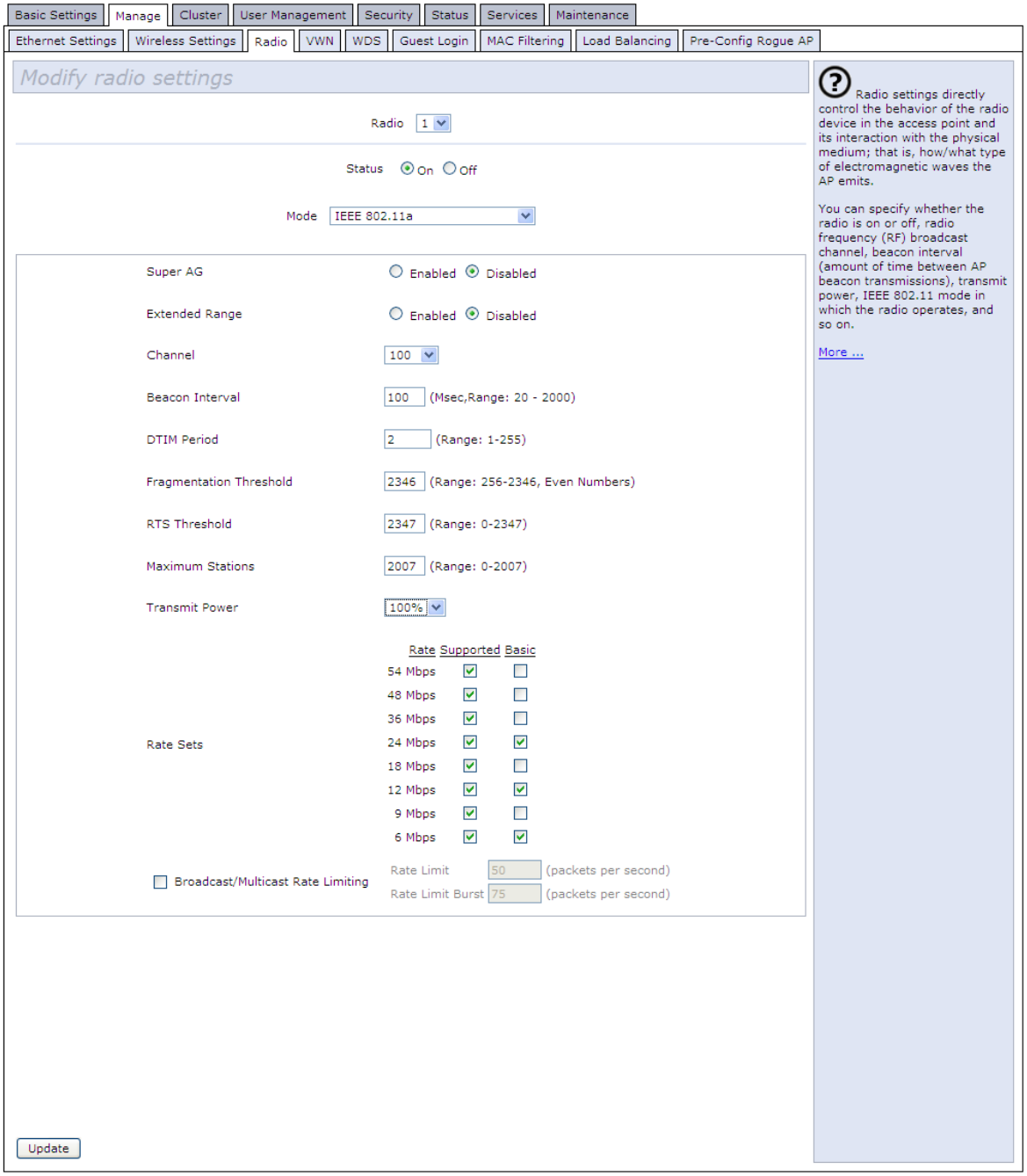


Figure 43: Radio Setting Page

Field	Description
Radio	Specify Radio One or Radio Two. The rest of the settings on this tab apply to the radio selected in this field. Be sure to configure settings for both radios. **Note:** Radio One (5GHz band) might not be available in the specific country domains. Therefore, you could not configure this radio.
Status	Specify whether you want the radio on or off by clicking **On** or **Off**.

Field	Description
Mode	The Mode defines the Physical Layer (PHY) standard being used by the radio. The AT-TQ2403 is available as a dual band access point. Select one of these modes: For Radio Interface 1 • IEEE 802.11a • Atheros Turbo 5 GHz • Atheros Dynamic Turbo 5 GHz For Radio Interface 2 • IEEE 802.11b • IEEE 802.11g • Atheros Turbo 2.4 GHz • Atheros Dynamic Turbo 2.4 GHz **Note:** • Different modes may be available depending on whether Radio One or Radio Two is selected in the Radio field above. • When you select the radio Mode, the appropriate set of Basic and Supported Rates for that Mode is automatically selected. (See description of "**Rate Sets**" below in this table.) • The turbo function depends on Country Domain and Product model. Not all country and model support the turbo function.
Enable Broadcast/Multicast Rate Limiting	Enabling multicast and broadcast rate limiting can improve overall network performance by limiting the number of packets transmitted across the network. Some protocols use multicast and broadcast packets for traffic that the majority of nodes on a network are uninterested in. For example, ARP requests for other machines, DHCP or BOOTP messages. For some protocols, if you set a rate limit control you limit the number of redundant packets transmitted across the network. Typically, any filtered traffic will be retransmitted at a later time and will not cause difficulties. • To enable Multicast and Broadcast Rate Limiting, click **Enabled**. • To disable Multicast and Broadcast Rate Disabled, click **Disabled**. By default the Multicast/Broadcast Rate Limiting option is disabled. Until you enable Multicast/Broadcast Rate Limiting, the following fields will be disabled.
Broadcast/Multicast Rate Limit	Enter the rate limit you want to set for multicast and broadcast traffic. The limit should be greater than 1, but less than 50 packets per second. Any traffic that falls below this rate limit will always conform and be transmitted to the appropriate destination.

Field	Description
Broadcast/Multicast Rate Limit Burst	Setting a rate limit burst determines how much traffic bursts can be before all traffic exceeds the rate limit. This burst limit allows intermittent bursts of traffic on a network above the set rate limit. The default and maximum rate limit burst setting is 75 packets per second.
Super AG	Enabling Super AG provides better performance by increasing radio throughput. Keep in mind that, with Super AG enabled, the access point transmissions will consume more bandwidth. • To enable Super AG, click **Enabled**. • To disable Super AG, click **Disabled**.
Extended Range	Atheros Extended Range (XR) is a proprietary method for implementing low rate traffic over longer distances. It is transparent to XR enabled clients and access points and is designed to be interoperable with the 802.11 standard in 802.11g and 802.11a modes. There is no support for Atheros XR in 802.11b, Atheros Turbo 5 GHz, or Atheros Dynamic Turbo 5 GHz. Enabling Atheros XR will extend the range over which your client and access point can operate. • To enable Extended Range, click **Enabled**. • To disable Extended Range, click **Disabled**. This option will not be available if you selected the hardware mode IEEE 802.11b, Atheros Turbo 5 GHz, or Atheros Dynamic Turbo 5 GHz. Atheros XR is not supported by these hardware modes.
Channel	The Channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving. The range of channels and the default channel are determined by the Mode of the radio interface. "Auto" is the recommended mode because it automatically detects the best channel choices based on signal strength, traffic loads, and so on. If you select a number from the list as the operating channel, due to DFS function (See "802.11h Regulatory Domain Control"), the actual operating channel might be different from your selection. If you want to know the current operation channel, please reference to Chapter 10: Maintenance and Monitoring (**status -> Interface**) the value of channel of Wireless Settings.
Beacon Interval	Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second). The Beacon Interval value is set in milliseconds. Enter a value from 20 to 2000.

Field	Description
DTIM Period	All Beacon frames include a Traffic Information Map information element (TIM IE). In some beacon frames, the TIM IE includes a Delivery Traffic Information Map (DTIM) message. These special DTIM beacons are sent at an interval specified in the DTIM period. Another way of expressing this is: Every xth TIM IE is DTIM (where X= DTIM Period) The DTIM beacon alerts the clients that multicast and broadcast packets buffered at the AP will be transmitted immediately after the transmission of this beacon frame. To set the DTIM Period for an AP, specify a DTIM period within the given range (1 - 255). The higher the DTIM period, the longer the delay between the delivery of multicast frames. The DTIM period, measured in beacon intervals, indicates the number of beacons between two consecutive DTIM beacons. For example, if you set this to "1" clients will check for buffered data on the AP at every beacon. If you set this to "2", clients will check on every other beacon. If you set this to 10, clients will check on every 10th beacon.
Fragmentation Threshold	Specify a number between 256 and 2,346 to set the frame size threshold in bytes. The fragmentation threshold is a way of limiting the size of packets (frames) transmitted over the network. If a packet exceeds the fragmentation threshold set here, the fragmentation function will be activated and the packet will be sent as multiple 802.11 frames. If the packet being transmitted is equal to or less than the threshold, fragmentation will not be used. Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation. Fragmentation involves more overhead both because of the extra work of dividing up and reassembling of frames it requires, and because it increases message traffic on the network. However, fragmentation can help improve network performance and reliability if properly configured. Sending smaller frames (by using lower fragmentation threshold) may help with some interference problems; for example, with microwave ovens. By default, fragmentation threshold is 2346. We recommend not using fragmentation unless you suspect radio interference. The additional headers applied to each fragment increase the overhead on the network and can greatly reduce throughput.

Field	Description
RTS Threshold	Specify an RTS Threshold value between 0 and 2347. The RTS threshold specifies the packet size at which packet transmission is governed by the RTS/CTS transaction. If you specify a low threshold value, RTS packets will be sent more frequently. This will consume more bandwidth and reduce the throughput of the packet. On the other hand, sending more RTS packets can help the network recover from interference or collisions which might occur on a busy network, or on a network experiencing electromagnetic interference.
Maximum Stations	Specify the maximum number of stations allowed to access an individual WLAN (i.e., Internal, Guest, or VWN) on this radio, at any one time. You can enter a value between 0 and 2007.
Transmit Power	Provide a percentage value to set the transmit power for this access point. The default is to have the access point transmit using 100 percent of its power. **Recommendations:** • For most cases, we recommend keeping the default and having the transmit power set to 100 percent. This is more cost-efficient as it gives the access point a maximum broadcast range, and reduces the number of APs needed. • To increase capacity of the network, place APs closer together and reduce the value of the transmit power. This will help reduce overlap and interference among APs. A lower transmit power setting can also keep your network more secure because weaker wireless signals are less likely to propagate outside of the physical location of your network.

Field	Description
Rate Sets	Check the transmission rate sets you want the access point to support and the basic rate sets you want the access point to advertise. **Rates** are expressed in megabits per second. **Supported Rate Sets** indicate rates that the access point supports. You can check multiple rates (click a checkbox to select or de-select a rate). The AP will automatically choose the most efficient rate based on factors like error rates and distance of client stations from the AP. **Basic Rate Sets** indicate rates that the access point will advertise to the network for the purposes of setting up communication with other APs and client stations on the network. It is generally more efficient to have an AP broadcast a subset of its supported rate sets. To support both "b" and "g" clients, change the radio Mode to IEEE 802.11g. The Web UI will automatically select the default Rate Sets that allow both "b" and "g" clients to connect. To support only "g" clients, change the radio Mode to IEEE 802.11g. The Web UI will automatically select the default Rate Sets. Now add 24, 12, and 6 as Basic Rates. This will prevent "b" clients from connecting since they do not support these rates, but will allow "g" clients to connect since they are required by the standard to support these rates. For more information, see description of "**Mode**" above in this table.

Updating Settings

To update Radio settings:

1. Navigate to the **Radio** tab page.
2. Configure the radio settings as required.
3. Click the **Update** button to apply the changes.

Note: Keep in mind that only displayed settings will be applied to selected radio when you click **Update**. Please configure each radio one by one, and be sure to click **Update** to submit your setting.

Chapter 16: Controlling Access by MAC Address Filtering

A Media Access Control (MAC) address is a hardware address that uniquely identifies each node of a network. All IEEE 802 network devices share a common 48-bit MAC address format, usually displayed as a string of 12 hexadecimal digits separated by colons, for example FE:DC:BA:09:87:65.

Each wireless network interface card (NIC) used by a wireless client has a unique MAC address.

You can control client access to your wireless network by switching on "MAC Filtering" and specifying a list of approved MAC addresses. When MAC Filtering is on, only clients with a listed MAC address can access the network.

The following sections describe how to use MAC address filtering on the AT-TQ2403 Management Software:

- Navigating to MAC Filtering Settings
- Using MAC Filtering
- Updating Settings

Navigating to MAC Filtering Settings

To enable filtering by MAC address, navigate to the **Manage > MAC Filtering** tab, and update the fields as described below.

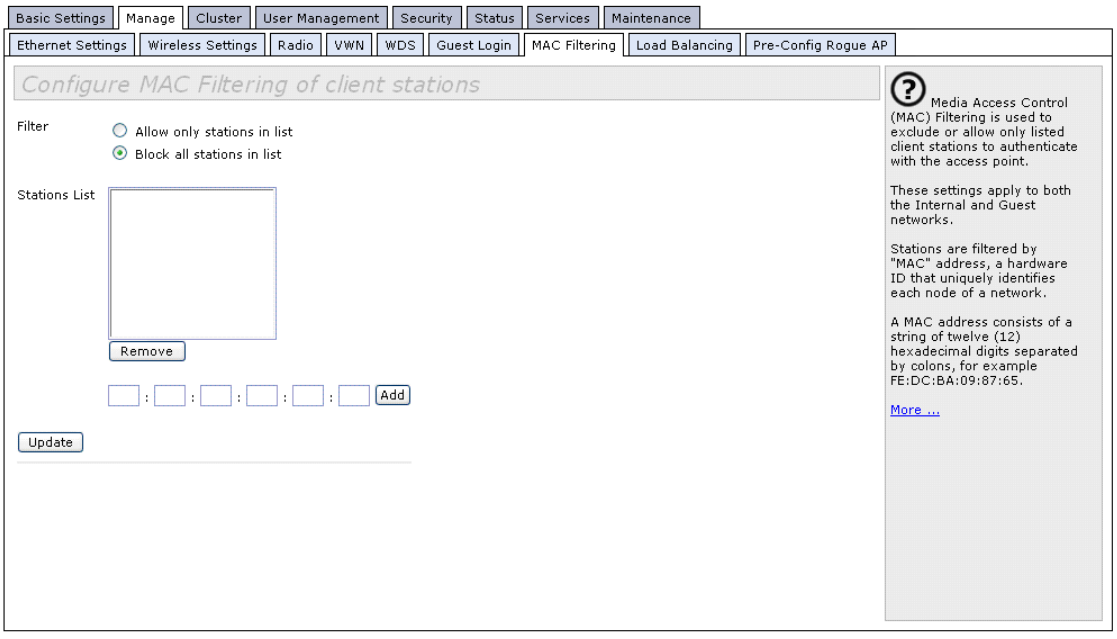


Figure 44: MAC Filtering Setting Page

Using MAC Filtering

This page allows you to control access to AT-TQ2403 Management Software based on *Media Access Control* (MAC) addresses. Based on how you set the filter, you can allow only client stations with a listed MAC address or *prevent* access to the stations listed.

For the Guest interface, MAC Filtering settings apply to both BSSes.

MAC Filtering settings apply to both radios.

Note: Only 1024 MAC addresses are allowed.

Field	Description
Filter	To set the MAC Address **Filter**, click one of the following radio buttons: • Allow only stations in the list • Block all stations in list
Stations List	To add a MAC Address to Stations List, enter its 48-bit MAC address into the lower text boxes, then click **Add**. The MAC Address is added to the Stations List. To remove a MAC Address from the Stations List, select its 48-bit MAC address, then click **Remove**. The stations in the list will either be allowed or prevented from accessing the AP based on how you set the Filter.

Updating Settings

To update MAC settings:

1. Navigate to the **MAC Filtering** tab page.
2. Configure the MAC settings as required.
3. Click the **Update** button to apply the changes.

Chapter 17: Load Balancing

The AT-TQ2403 Management Software allows you to balance the distribution of wireless client connections across multiple access points. Using load balancing, you can prevent scenarios where a single access point in your network shows performance degradation because it is handling a disproportionate share of the wireless traffic.

The following sections describe how to configure Load Balancing on your wireless network:

- Understanding Load Balancing
    - Identifying the Imbalance: Overworked or Under-utilized Access Points
    - Specifying Limits for Utilization and Client Associations
    - Load Balancing and QoS
- Navigating to Load Balancing Settings
- Configuring Load Balancing
- Updating Settings

Understanding Load Balancing

Like most configuration settings on the AT-TQ2403 Management Software, load balancing settings are shared among clustered access points.

Note: In some cases you might want to set limits for only one access point that is consistently over-utilized. You can apply unique settings to a particular access point if it is operating in stand-alone mode. (See "Understanding Clustering" and "Navigating to Access Points Management".)

Identifying the Imbalance: Overworked or Under-utilized Access Points

A typical scenario is that a comparison of Client Association data and Transmit/Receive data for multiple access points allows you to identify an access point that is consistently handling a disproportionately large percentage of wireless traffic. This can happen when location placement or other factors causes one access point to transmit the strongest signal to a majority of clients on a network. By default, that access point will receive most of client requests while the other access points stay idle much of the time.

Imbalances in distribution of wireless traffic across access points will be evident in Client Association statistics and Transmit/Receive statistics, which will show higher "Utilization" rates on overworked APs and conversely, higher "Idle" times on under-utilized APs. An AP that is handling more than its fair share of traffic might also show slower data rates or lower transmit/receive rates due to the overload.

Specifying Limits for Utilization and Client Associations

You can correct for imbalances in network AP utilization by enabling load balancing and setting limits on utilization rates and number of client associations allowed per access point.

Load Balancing and QoS

Load balancing also plays a part in contributing to *Quality of Service* (QoS) for *Voice Over IP* (VoIP) and other such time-sensitive applications competing for bandwidth and timely access to the air waves on a wireless network. For more information about configuring your network for QoS, see "Configuring Quality of Service (QoS)".

Navigating to Load Balancing Settings

On the Administration UI, navigate to the **Manage > Load Balancing** tab, and update the fields as described in the next section.

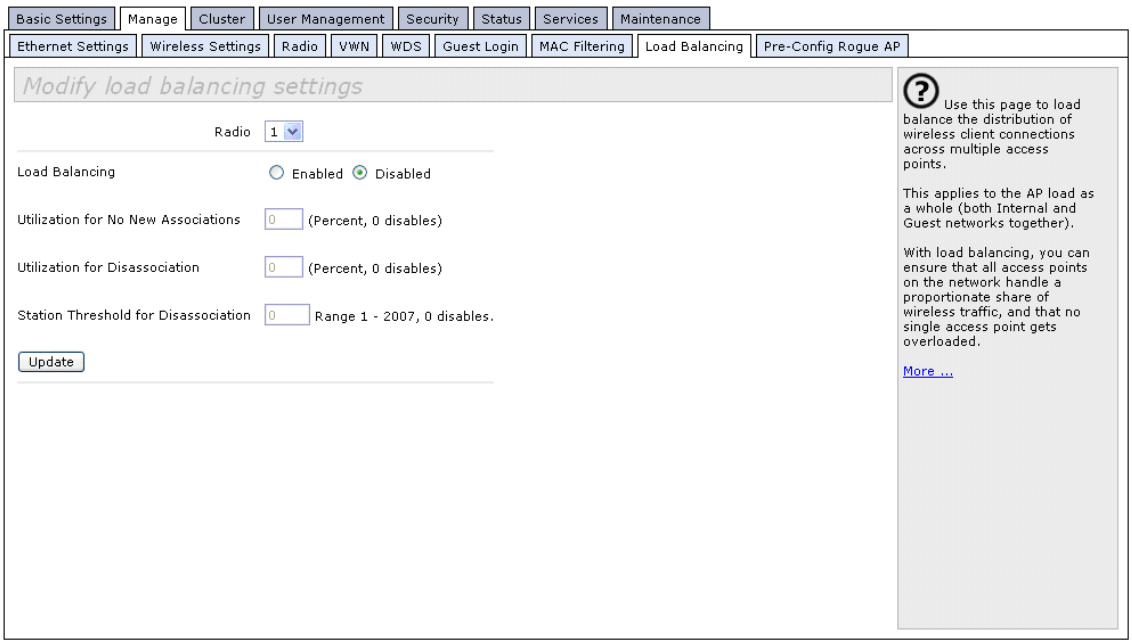


Figure 45: Load Balancing Settings Page

Configuring Load Balancing

To configure load balancing, *enable* **Load Balancing** and set limits and behavior to be triggered by a specified utilization rate of the access point.

Note:

- Even when clients are disassociated from an AP, the network will still provide continuous service to client stations if another access point is within range so that clients can re-connect to the network. Clients should automatically retry the AP they were originally connected to and other APs on the subnet. Clients who are disassociated from one AP should experience a seamless transition to another AP on the same subnet.
- Load Balancing settings apply to the AP load as a whole. When Guest access is enabled, the settings apply to both Internal and Guest networks together.
- Load Balancing settings apply to both radios but the load of each radio is calculated independently and includes both the Internal and Guest network (when Guest access is enabled).

Field	Description
Load Balancing	To enable load balancing on this access point, click **Enable**. To disable load balancing on this access point, click **Disable**.
Utilization for No New Associations	Utilization rate limits relate to wireless bandwidth utilization. Provide a bandwidth utilization rate percentage limit for this access point to indicate when to stop accepting new client associations. When the utilization rate for this access point exceeds the specified limit, no new client associations will be allowed on this access point. If you specify 0 in this field, all new associations will be allowed regardless of the utilization rate.
Utilization for Disassociation	Utilization rate limits relate to wireless bandwidth utilization. Provide a bandwidth utilization rate percentage limit for this access point to indicate when to disassociate current clients. When the utilization rate exceeds the specified limit, a client currently associated with this access point will be disconnected. If you specify 0 in this field, current clients will never be disconnected regardless of the utilization rate.
Stations Threshold for Disassociation	Specify the number of client stations you want as a "stations threshold" for disassociation. If the number of client stations associated with the AP at any one time is equal to or less than the number you specify here, no stations will be disassociated regardless of the "Utilization for Disassociation" value. Theoretically, the maximum number of client stations allowed is 2007. **Note:** We recommend setting the maximum to between 30 and 50 client stations. This allows for a workable load on the access point, given that bandwidth is shared among the AP clients.

Updating Settings

To update load balancing settings:

1. Navigate to the **Load Balancing** tab page.
2. Configure the load balancing settings as required.
3. Click the **Update** button to apply the changes.

Chapter 18: Pre-Config Rogue AP

Pre-config Rogue Configuration notifies you when access points are not in the Access Points list. Access points are filtered by MAC address, a hardware ID number that uniquely identifies each node of a network. A MAC address consists of a string of twelve (12) hexadecimal digits separated by colons, for example FE:DC:BA:09:87:65.

These settings apply to the internal and guest networks of both radios.

When a MAC address does not match an entry in the Access Points list, a SNMP trap will be sent. SNMP traps enable an agent to notify the management station of significant events by sending an unsolicited SNMP message.

The following sections describe how to use Pre-Config Rogue AP on the AT-TQ2403 Management Software:

- Navigating to Pre-Config Rogue AP Settings
- Using Pre-Config Rogue AP
- Updating Settings

Navigating to Pre-Config Rogue AP Settings

To enable AP Detection, go to **Manage > Pre-Config Rogue AP** tab, and update the fields as described below.

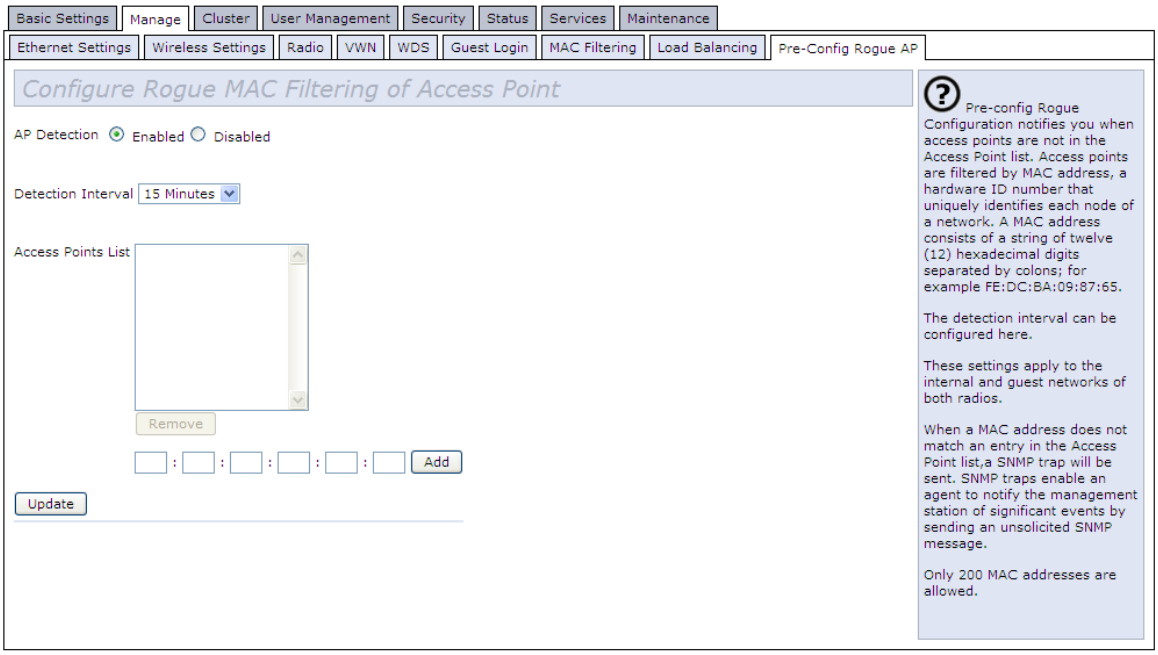


Figure 46: Pre-Config Rogue AP Page

Using Pre-Config Rogue AP

Field	Description
AP Detection	To set AP Detection, click **Enabled**.
Detection Interval	Use the drop-down menu to specify the schedule for AP Detection. A range of intervals is provided, from "15 Minutes" to "4 Weeks". The default is "15 Minutes"
Access Points List	To add a MAC Address to the Access Point List, enter the 48-bit MAC address into the lower text boxes, then click **Add**. The MAC Address is added to the Access Point List. To remove a MAC Address from the Access Point List, select the 48-bit MAC address, then click **Remove**. Only 200 MAC addresses are allowed.

Updating Settings

To update Rouge AP settings:

1. Navigate to the **Pre-Config Rogue AP** tab page.
2. Configure the Pre-Config Rogue AP settings as required.
3. Click the **Update** button to apply the changes.

Chapter 19: Configuring Quality of Service (QoS)

Quality of Service (QoS) provides you with the ability to specify parameters on multiple queues for increased throughput and better performance of differentiated wireless traffic like Voice-over-IP (VoIP), other types of audio, video, and streaming media as well as traditional IP data over the AT-TQ2403 Management Software.

The following sections describe how to configure Quality of Service queues on the AT-TQ2403 Management Software:

- Understanding QoS
    - QoS and Load Balancing
    - 802.11e and WMM Standards Support
    - QoS Queues and Parameters to Coordinate Traffic Flow
    - 802.1q and DSCP tags
- Navigating to QoS Settings
- Configuring QoS Queues
    - Configuring AP EDCA Parameters
    - Enabling/Disabling Wi-Fi Multimedia
    - Configuring Station EDCA Parameters
- Updating Settings

Understanding QoS

A primary factor that affects QoS is network congestion due to an increased number of clients attempting to access the air waves and higher traffic volume competing for bandwidth during a busy time of day. The most noticeable degradation in service on a busy, overloaded network will be evident in time-sensitive applications like Video, Voice-over-IP (VoIP), and streaming media.

Unlike typical data files which are less affected by variability in QoS, Video, VoIP and streaming media must be sent in a specific order at a consistent rate and with minimum delay between Packet transmissions.

If the quality of service is compromised, the audio or video will be distorted.

QoS and Load Balancing

By using a combination of load balancing (see "Load Balancing") and QoS techniques, you can provide a high quality of service for time-sensitive applications even on a busy network. Load balancing is a way of better distributing the traffic volume across access points. QoS is a means of allocating bandwidth and network access based on transmission priorities for different types of wireless traffic within a single access point.

802.11e and WMM Standards Support

QoS describes a range of technologies for controlling data streams on shared network connections. The IEEE 802.11e task group has defined a QoS standard for transmission quality and availability of service on wireless networks. QoS is designed to provide better network service by limiting Jitter, Latency, and Packet Loss; supporting dedicated bandwidth for time-sensitive or mission critical applications, and prioritizing wireless traffic for channel access.

As with all IEEE 802.11 working group standards, the goal is to provide a standard way of implementing QoS features so that components from different companies are interoperable.

The AT-TQ2403 Management Software provides QoS based on the Wi-Fi Wireless Multimedia (WMM) specification which are implementations of a subset of 802.11e features.

Both access points and wireless clients (laptops, consumer electronics products) can be WMM-enabled by the Wi-Fi Alliance.

QoS Queues and Parameters to Coordinate Traffic Flow

Configuring QoS options on the AT-TQ2403 Management Software consists of setting parameters on existing queues for different types of wireless traffic. You can configure different minimum and maximum wait times for the transmission of packets in each queue based on the requirements of the media being sent. Queues automatically provide minimum transmission delay for Voice, Video, multimedia, and mission critical applications, and rely on best-effort parameters for traditional IP data.

For example, time-sensitive Voice, Video, and multimedia are given effectively higher priority for transmission (lower wait times for channel access), while other applications and traditional IP data which are less time-sensitive but often more data-intensive are expected to tolerate longer wait times.

The AT-TQ2403 Management Software implements QoS based on the IEEE Wireless Multimedia (WMM) standard. A Linux-based queuing class is used to tag packets and establish multiple queues. The queues provided offer built-in prioritization and routing based on the type of data being transmitted.

The Administration UI provides a way for you to configure parameters on the queues.

QoS Queues and Diff-Serv Code Point (DSCP) on Packets

QoS on the AT-TQ2403 Management Software leverages WMM information in the IP packet header related to Diff-Serv Code Point (DSCP). Every IP packet sent over the network includes a DSCP field in the header that indicates how the data should be prioritized and transmitted over the network. The DSCP field consists of a 6 bit value defined by the local administration. For WMM, Wi-Fi Alliance suggests a particular mapping for DSCP values. For more information see "VLAN Priority".

The access point examines the DSCP field in the headers of all packets that pass through the AP. Based on the value in a packet's DSCP field, the AP prioritizes the packet for transmission by assigning it to one of the queues. This process occurs automatically, regardless of whether you deliberately configure QoS or not.

A different type of data is associated with each queue. The queue and associated priorities and parameters for transmission are as follows:

- Data 0 (Voice). Highest priority queue, minimum delay. Time-sensitive data such as Voice over IP(VoIP) is automatically sent to this queue.

- Data 1 (Video). High priority queue, minimum delay. Time-sensitive data such as Video and other streaming media are automatically sent to this queue.

- Data 2 (Best Effort). Medium priority queue, medium throughput and delay. Most traditional IP data

is sent to this queue.

- Data 3 (Background). Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).

Using the QoS settings on the Administration UI, you can configure Enhanced Distributed Channel Access (EDCA) parameters that determine how each queue is treated when it is sent by the access point to the client or by the client to the access point.

Note: Wireless traffic travels:

- Downstream from the access point to the client station
- Upstream from client station to access point
- Upstream from access point to network
- Downstream from network to access point

With WMM enabled, QoS settings on the AT-TQ2403 Management Software affect the first two of these; downstream traffic flowing from the access point to client station (AP EDCA parameters) and the upstream traffic flowing from the station to the access point (station EDCA parameters).

The other phases of the traffic flow (to and from the network) are not under control of the QoS settings on the AP.

EDCA Control of Data Frames and Arbitration Interframe Spaces

Data is transmitted over 802.11 wireless networks in frames. A Frame consists of a discrete portion of data along with some descriptive meta-information packaged for transmission on a wireless network.

Note: A Frame is similar in concept to a *Packet*, the difference being that a packet operates on the Network layer (layer 3 in the OSI model) whereas a frame operates on the Data-Link layer (layer 2 in the OSI model).

Each frame includes a source and destination MAC address, a control field with protocol version, frame type, frame sequence number, frame body (with the actual information to be transmitted) and frame check sequence for error detection.

The 802.11 standard defines various *frame* types for management and control of the wireless infrastructure, and for data transmission. 802.11 frame types are (1) management frames, (2) control frames, and (3) data frames. Management and control frames (which manage and control the availability of the wireless infrastructure) automatically have higher priority for transmission.

802.11e uses interframe spaces to regulate which frames get access to available channels and to coordinate wait times for transmission of different types of data.

Management and control frames wait a minimum amount of time for transmission; they wait a short interframe space (SIF). These wait times are built-in to 802.11 as infrastructure support and are not configurable.

The AT-TQ2403 Management Software supports the Enhanced Distribution Coordination Access (EDCA) as defined by the 802.11e standard. EDCA, which is an enhancement to the DCF standard and

is based on CSMA/CA protocol, defines the interframe space (IFS) between data frames. Data frames wait for an amount of time defined as the arbitration interframe space (AIFS) before transmitting.

This parameter is configurable.

Random Backoff and Minimum / Maximum Contention Windows

If an access point detects that the medium is in use (busy), it uses the DCF random backoff timer to determine the amount of time to wait before attempting to access a given channel again. Each access point waits some random period of time between retries. The waiting time (initially a random value within a range specified as the Minimum Contention Window) increases exponentially up to a specified limit (Maximum Contention Window). The random delay avoids most of the collisions that would occur if multiple APs got access to the medium at the same time and tried to transmit data simultaneously. The more active users you have on a network, the more significant the performance gains of the backoff timer will be in reducing the number of collisions and retransmissions.

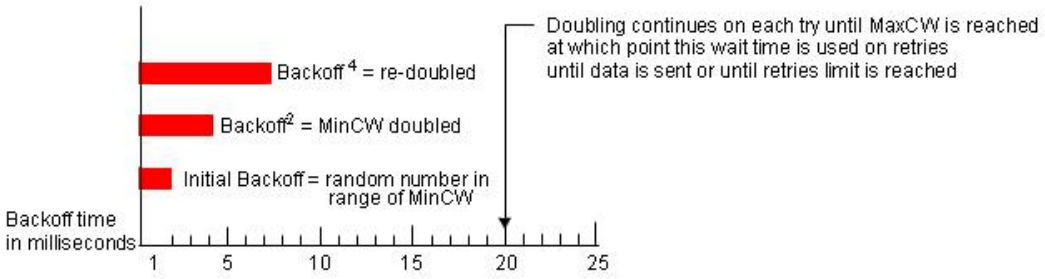


Figure 47: Backoff timer Diagram

The random backoff used by the access point is a configurable parameter. To describe the random delay, a "Minimum Contention Window" (MinCW) and a "Maximum Contention Window" (MaxCW) is defined.

- The value specified for the Minimum Contention Window is the upper limit of a range for the initial random backoff wait time. The number used in the random backoff is initially a random number between 0 and the number defined for the Minimum Contention Window.

- If the first random backoff time ends before successful transmission of the data frame, the access point increments a retry counter, and doubles the value of the random backoff window. The value specified in the Maximum Contention Window is the upper limit for this doubling of the random backoff. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached.

Packet Bursting for Better Performance

The AT-TQ2403 Management Software includes 802.11e based *packet bursting* technology that increases data throughput and speed of transmission over the wireless network. Packet bursting enables the transmission of multiple packets without the extra overhead contention for the wireless medium. The effect of this is to increase network speed and data throughput. The size of packet bursts allowed (maximum burst length) is a configurable parameter.

Transmission Opportunity (TXOP) Interval for Client Stations

The Transmission Opportunity (TXOP) is an interval of time when a Wi-Fi Multimedia (WMM) client station has the right to initiate transmissions onto the wireless medium (WM).

802.1q and DSCP tags

IEEE 802.1q is an extension of the IEEE 802 standard and is responsible for QoS provision. One purpose of 802.1q is to prioritize network traffic at the data link/ MAC layer.

The 802.1q tag includes a three-bit field for prioritization, which allows packets to be grouped into various traffic classes. Eight priority levels are defined. The highest priority is seven, which might go to network- critical traffic (voice). The lowest priority level is zero, this is used as a best-effort default, it is invoked automatically when no other value has been set.

Note: It is important to note that 802.1q prioritization will not work unless QoS and WMM are enabled. WMM must be enabled on both the AP and on the client connecting to the AP.

The flow diagram below outlines the way in which tags are retrieved and traffic prioritized on a network.

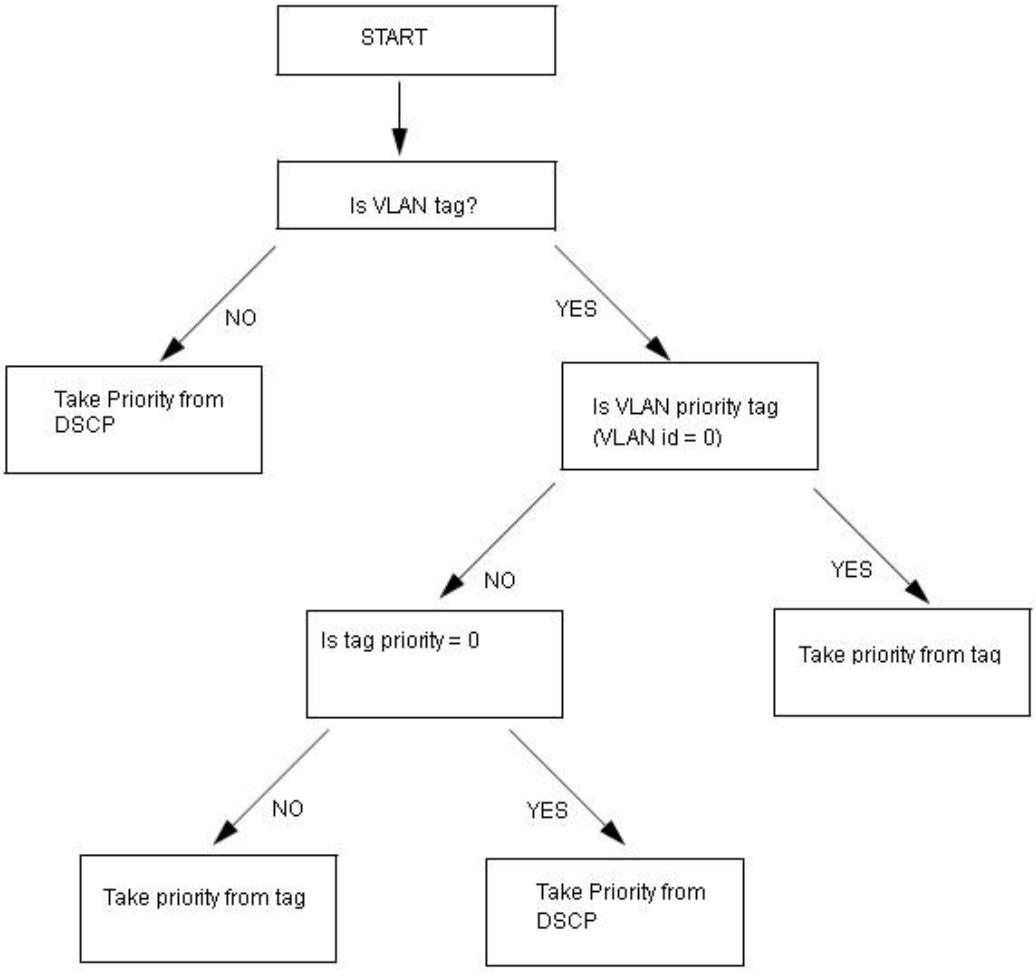


Figure 48: 802.1q Tag Retrieving Flow Diagram

The table below outlines the VLAN priority and DSCP values.

Table 1 VLAN Priority

VLAN Priority	Priority	DSCP value
0	Best Effort	0
1	Background	16
2	Background	8
3	Best Effort	24
4	Video	32
5	Video	40
6	Voice	48
7	Voice	56

Navigating to QoS Settings

To set up queues for QoS, navigate to the Services > QoS tab, and configure settings as described below.

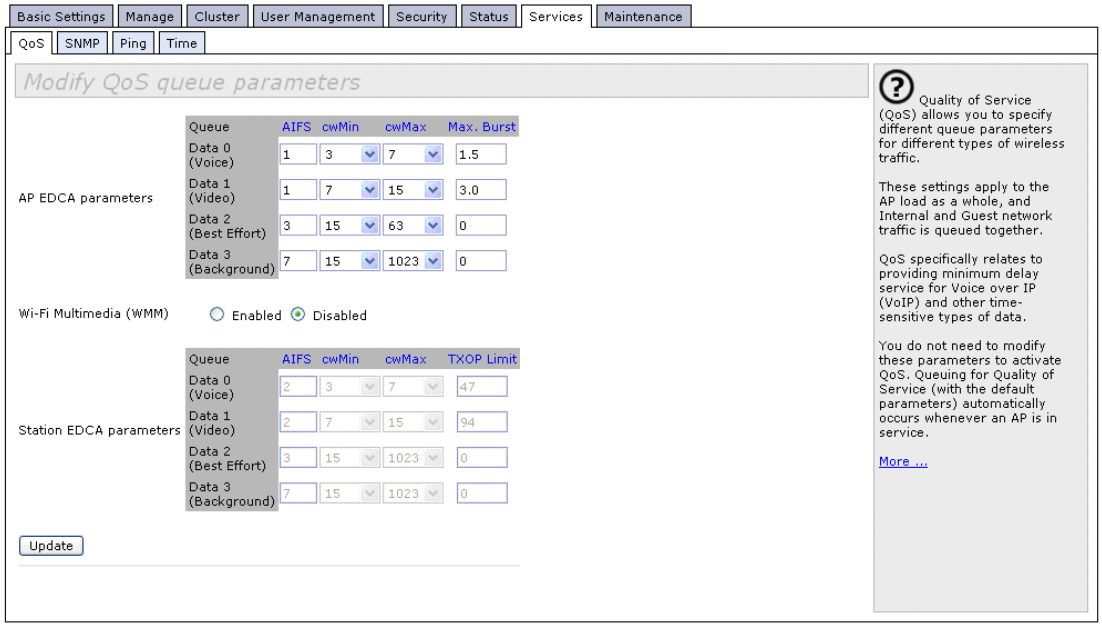


Figure 49: QoS Setting Page

Configuring QoS Queues

Configuring Quality of Service (QoS) on the AT-TQ2403 Management Software consists of setting parameters on existing queues for different types of wireless traffic, and effectively specifying minimum and maximum wait times (via Contention Windows) for transmission. The settings described here apply to data transmission behavior on the access point only, not to that of the client stations.

Note:

- For the Guest interface or VWNs (Virtual APs), QoS queue settings apply to the access point load as a whole (all BSSs together).
- These settings apply to both radios but the traffic for each radio is queued independently.

Configuring Quality of Service includes:

- Configuring AP EDCA Parameters
- Enabling/Disabling Wi-Fi Multimedia
- Updating Settings

Configuring AP EDCA Parameters

AP Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the access point to the client station. The default values for the AP and station EDCA parameters are those suggested by the Wi-Fi alliance in the WMM specification. In normal use these values should not need to be changed. Changing these values will affect the QoS provided.

Field	Description
Queue	Queues are defined for different types of data transmitted from AP-to-station: **Data 0 (Voice)** Low latency and guaranteed bandwidth. Time-sensitive data such as VoIP should be sent to this queue. **Data 1(Video)** Guaranteed bandwidth. Time-sensitive video data and any streams that have a fixed bandwidth should be sent to this queue. **Data 2 (best effort)** Most traditional IP data is sent to this queue. **Data 3 (Background)** Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example). For more information, see "QoS Queues and Parameters to Coordinate Traffic Flow".

Field	Description
AIFS **(Inter-Frame Space)**	The Arbitration Inter-Frame Spacing (AIFS) specifies a wait time (in milliseconds) for data frames. Valid values for AIFS are 1 through 255. For more information, see "EDCA Control of Data Frames and Arbitration Interframe Spaces".
cwMin **(Minimum Contention Window)**	This parameter is input to the algorithm that determines the initial random backoff wait time ("window") for retry of a transmission. The value specified here in the Minimum Contention Window is the upper limit (in milliseconds) of a range from which the initial random backoff wait time is determined. The first random number generated will be a number between 0 and the number specified here. If the first random backoff wait time expires before the data frame is sent, a retry counter is incremented and the random backoff value (window) is doubled. Doubling will continue until the size of the random backoff value reaches the number defined in the Maximum Contention Window. Valid values for the "cwmin" are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. For more information, see "Random Backoff and Minimum / Maximum Contention Windows".
cwMax **(Maximum Contention Window)**	The value specified here in the Maximum Contention Window is the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. Once the Maximum Contention Window size is reached, retries will continue until a maximum number of retries allowed is reached. Valid values for the "cwmax" are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. For more information, see "Random Backoff and Minimum / Maximum Contention Windows".

Field	Description
Max. Burst Length	AP EDCA Parameter Only (The Max. Burst Length applies only to traffic flowing from the access point to the client station.) This value specifies (in milliseconds) the Maximum Burst Length allowed for packet bursts on the wireless network. A packet burst is a collection of multiple frames transmitted without header information. The decreased overhead results in higher throughput and better performance. Valid values for maximum burst length are 0.0 through 999.9. For more information, see "Packet Bursting for Better Performance".

Enabling/Disabling Wi-Fi Multimedia

By default, Wi-Fi MultiMedia (WMM) is enabled on the access point. With WMM enabled, QoS prioritization and coordination of wireless medium access is on. With WMM enabled, QoS settings on the AT-TQ2403 Management Software control *downstream* traffic flowing from the access point to client station (AP EDCA parameters) and the *upstream* traffic flowing from the station to the access point (station EDCA parameters).

- To disable WMM extensions, click **Disabled**.
- To enable WMM extensions, click **Enabled**.

Configuring Station EDCA Parameters

Station Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the client station to the access point.

Field	Description
Queue	Queues are defined for different types of data transmitted from station-to-AP: **Data 0 (Voice)** Low latency and guaranteed bandwidth. Time-sensitive data such as VoIP should be sent to this queue. **Data 1(Video)** Guaranteed bandwidth. Time-sensitive video data and any streams that have a fixed bandwidth should be sent to this queue. **Data 2 (best effort)** Most traditional IP data is sent to this queue. **Data 3 (Background)** Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).
AIFS (Inter-Frame Space)	The Arbitration Inter-Frame Spacing (AIFS) specifies a wait time (in milliseconds) for data frames.
cwMin (Minimum Contention Window)	This parameter is input to the algorithm that determines the initial random backoff wait time ("window") for retry of a transmission. The value specified here in the Minimum Contention Window is the upper limit (in milliseconds) of a range from which the initial random backoff wait time is determined. The first random number generated will be a number between 0 and the number specified here. If the first random backoff wait time expires before the data frame is sent, a retry counter is incremented and the random backoff value (window) is doubled. Doubling will continue until the size of the random backoff value reaches the number defined in the Maximum Contention Window.

Field	Description
cwMax (Maximum Contention Window)	The value specified here in the Maximum Contention Window is the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. Once the Maximum Contention Window size is reached, retries will continue until a maximum number of retries allowed is reached.
TXOP Limit	Station EDCA Parameter Only (The TXOP Limit applies only to traffic flowing from the client station to the access point.) The Transmission Opportunity (TXOP) is an interval of time when a WME client station has the right to initiate transmissions onto the wireless medium (WM). This value specifies (in milliseconds) the Transmission Opportunity (TXOP) for client stations; that is, the interval of time when a WMM client station has the right to initiate transmissions on the wireless network. Valid values for TXOP Limit are 0 through 65535.

Updating Settings

To update QoS settings:

1. Navigate to the **QoS** tab page.
2. Configure the QoS settings as required.
3. Click the **Update** button to apply the changes.

Chapter 20: Configuring the Wireless Distribution System (WDS)

The AT-TQ2403 Management Software lets you connect multiple access points using a Wireless Distribution System (WDS). WDS allows access points to communicate with one another wirelessly. This capability is critical in providing a seamless experience for roaming clients and for managing multiple wireless networks. It can also simplify the network infrastructure by reducing the amount of cabling required.

The following sections describe how to configure the WDS on the AT-TQ2403 Management Software:

- Understanding the Wireless Distribution System
    - Using WDS to Bridge Distant Wired LANs
    - Using WDS to Extend the Network Beyond the Wired Coverage Area
- Security Considerations Related to WDS Links
    - Understanding Static (WEP) Data Encryption
    - Understanding WPA (PSK) Data Encryption
    - Security Considerations Related to WDS Links
- Navigating to WDS Settings
- Configuring WDS Settings
- Updating Settings

Understanding the Wireless Distribution System

A Wireless Distribution System (WDS) is a technology that wirelessly connects access points, known as Basic Service Sets (BSS), to form what is known as an Extended Service Set (ESS).

Note: A BSS generally equates to an access point (deployed as a single-AP wireless "network"), except in cases where multi-BSSID features make a single access point look like two or more access points to the network. In such cases, the access point has multiple unique BSSIDs.

Using WDS to Bridge Distant Wired LANs

In an ESS, a network of multiple access points, each access point serves part of an area which is too large for a single access point to cover. You can use WDS to bridge distant Ethernets to create a single LAN. For example, suppose you have one access point which is connected to the network by Ethernet and serving multiple client stations in the Conference Room (LAN Segment 1), and another Ethernet-wired access point serving stations in the West Wing offices (LAN Segment 2). You can bridge the Conference Room and West Wing access points with a WDS link to create a single network for clients in both areas.

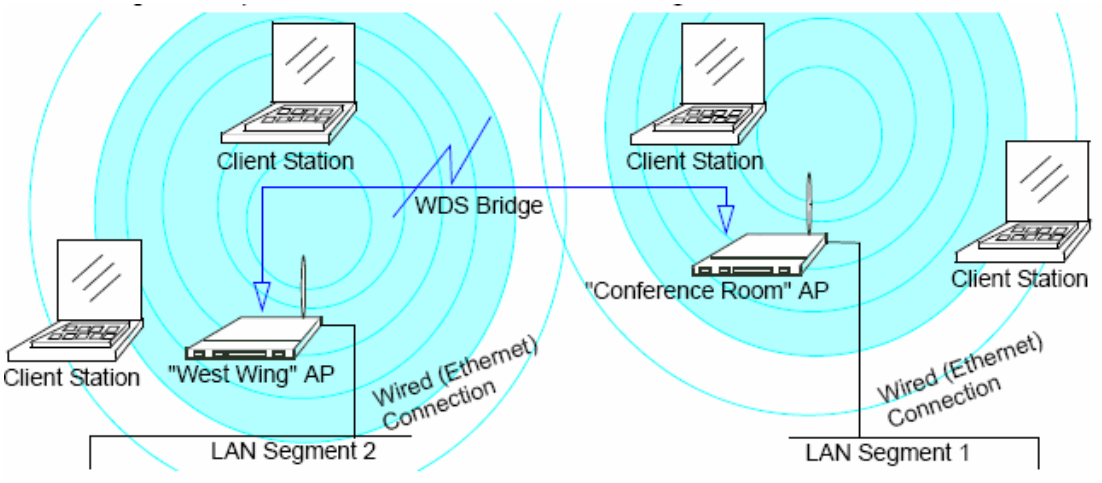


Figure 50: Bridge Distant Wired LAN by WDS Diagram

Using WDS to Extend the Network Beyond the Wired Coverage Area

An ESS can extend the reach of the network into areas where cabling would be difficult, costly, or inefficient.

For example, suppose you have an access point which is connected to the network by Ethernet and serving multiple client stations in one area ("East Wing" in our example) but cannot reach others which are out of range. Suppose also that it is too difficult or too costly to wire the distant area with Ethernet cabling. You can solve this problem by placing a second access point closer to the second group of stations ("Poolside" in our example) and bridge the two APs with a WDS link. This extends your network wirelessly by providing an extra hop to get to distant stations.

Security Considerations Related to WDS Links

It is important to set some type of security on WDS links. You can set any type of security on the WDS link, regardless of the security setting applied to the APs on the link. For example, you may have the security on AP1 set to None and the security on AP2 set to WEP. Even though both settings are different, you can choose to set the security on the WDS link as either None or WEP. The only exception to this rule is in the case of WPA (PSK). The WPA (PSK) security setting can only be set on the WDS link if you have set security on both AP1 and AP2 to either WPA Personal or WPA Enterprise.

Understanding Static (WEP) Data Encryption

Static Wired Equivalent Privacy (WEP) is a data encryption protocol for 802.11 wireless networks. Both access points in a given WDS link must be configured with the same security settings. For static WEP, either a static 64-bit (40-bit secret key + 24-bit initialization vector (IV)) or 128-bit (104-bit secret key + 24- bit IV) Shared Key is specified for data encryption.

You can enable Static WEP on the WDS link (bridge). When WEP is enabled, all data exchanged between the two access points in a WDS link is encrypted using a fixed WEP key that you provide.

Static WEP does not provide effective data protection to the level of other security modes available for service to client stations. If you use Static WEP on a LAN intended for secure wireless traffic you are putting your network at risk. Therefore, we recommend using WPA (PSK) encryption on any WDS links on an Internal network. Do not use Static WEP based WDS to bridge access points on the Internal network unless you have no concerns about the security risk for data traffic on that network. For more information on WPA (PSK), see “Understanding WPA (PSK) Data Encryption”.

For more information about the effectiveness of different security modes, see "Configuring Security". This topic also covers use of the unencrypted security mode for AP-to-station traffic on the Guest network, which is intended for less sensitive data traffic.

Understanding WPA (PSK) Data Encryption

Wi-Fi Protected Access (Pre-Shared Key) or WPA (PSK) is a more robust form of security than Static WEP. Formerly known as WPA-Home, WPA (PSK) works using a pre-shared key which is basically a shared password between the APs on a bridged link. WPA (PSK) provides enhanced 802.11 wireless security without the need for a RADIUS authentication infrastructure, which is both complicated and expensive to implement.

Since WPA (PSK) encryption relies upon a shared key, both APs on the WDS link must be set with the same key, otherwise they will not be able to communicate and share information.

Note: For security reasons it is recommended you change the shared keys on your WDS bridge on a regular basis.

For more information about the effectiveness of the different security modes, see "Configuring Security".

Navigating to WDS Settings

To specify the details of traffic exchange from this access point to others, navigate to the **Manage > WDS** tab, and update the fields as described below.

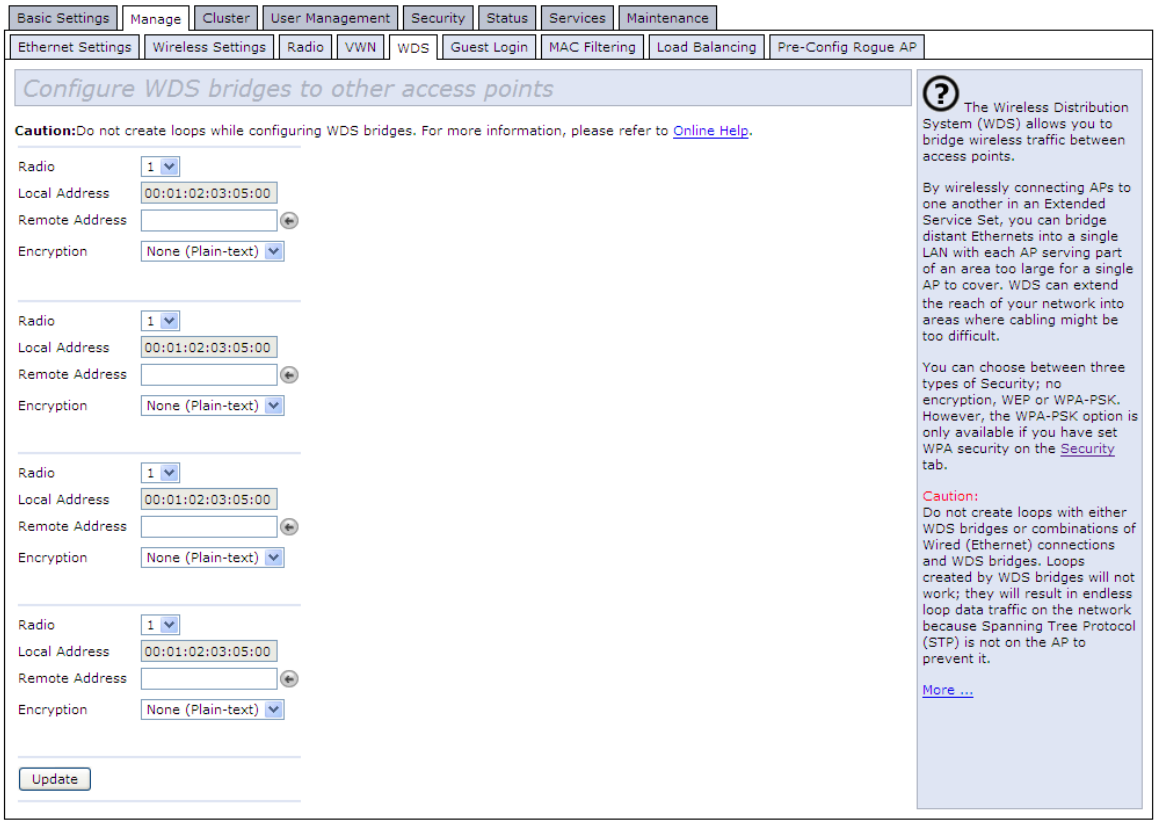


Figure 51: WDS Setting Page

Configuring WDS Settings

The following notes summarize some critical guidelines regarding WDS configuration. Please read all the notes before proceeding with WDS configuration.

Note:

- When using WDS, be sure to configure WDS settings on both access points participating in the WDS link.
- You can have only one WDS link between any pair of access points. That is, a remote MAC address may appear only once on the WDS page for a particular access point.
- Both access points participating in a WDS link must be on the same Radio channel and using the same IEEE 802.11 mode. (See "Configuring Radio Settings" for information on configuring the Radio mode and channel.)
- When 802.11h is operational, setting up WDS links can be difficult because of DFS function. See "802.11h Regulatory Domain Control". To avoid the WDS link disconnecting, when configure a WDS link, it is recommended to use radio 2, which is operating in the 2.4 GHz band. If you prefer using radio 1, it is recommended to configure your devices to operate on a channel other than 50 ~ 68 and 100 ~ 140.
- Do not create loops with either WDS bridges or combinations of wired (Ethernet) connections and WDS bridges.
- Do not create "backup" links. If you can trace more than one path between any pair of APs going through any combination of Ethernet or WDS links, you have a loop. You can only extend or bridge either the internal or guest network but not both.

To configure WDS on this access point, describe each AP intended to receive hand-offs and send information to this AP. Each destination AP needs the following description.

Field	Description
Local Address	Indicates the Media Access Control (MAC) addresses for this access point. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for the access point or interface. For each WDS link, the Local Address reflects the MAC address for the Internal interface on the selected radio (Radio One on WLAN0 or Radio Two WLAN1).

Field	Description
Remote Address	Specify the MAC address of the destination access point; that is, the access point to which data will be sent or "handed-off" and from which data will be received, in other words the AP to which you are creating the WDS bridge. Click the arrow to the right of the **Remote Address** field to see a list of all the available MAC Addresses and their associated SSIDs on the network. Select the appropriate MAC address from the list. **Note**: The SSID displayed in the drop-down list is simply to help you identify the correct MAC Address for the destination access point. This SSID is a separate SSID to that which you set for the WDS link. The two do not (and should not) be the same value or name.
Encryption	If you are unconcerned about security issues on the WDS link you may decide not to set any type of encryption. Alternatively, if you have security concerns you can choose between Static WEP, and WPA (PSK). **Note:** The types of encryption options available here will depend on the settings you have specified on the Security tabbed page. The WPA (PSK) option will only be an available option on the WDS page if you set the Mode on the Security tabbed page to WPA Personal or WPA Enterprise. **None (Plain Text):** If you set encryption to None, the data sent between the APs across the WDS bridge will not be encrypted, but rather will be sent as plain text. **WEP:** Specify whether you want Wired Equivalent Privacy (WEP) encryption enabled for the WDS link. *Wired Equivalent Privacy* (WEP) is a data encryption protocol for 802.11 wireless networks. Both access points on the WDS link must be configured with the same security settings. For static WEP, a static 64-bit (40-bit secret key + 24-bit initialization vector (IV)), 128-bit (104-bit secret key + 24-bit IV), 152-bit (128-bit secret key + 24-bit IV) Shared Key for data encryption. For more information on WEP security, see "Static WEP" **WPA (PSK):** Specify whether you want WPA (PSK) encryption enabled for the WDS link. Wi-Fi Protected Access Pre-Shared Key, WPA (PSK) is a more secure form of encryption than WEP. When you use WPA (PSK) encryption, each peer of the WDS link must be set with the same unique key, otherwise the APs will not be able to communicate with one another. **Note:** Each peer of the WDS link also must have the same setting of the WPA Version and Cipher Suites on the **Security** tabbed page. For more information on WPA (PSK) security, see "WPA Personal".

Example of Configuring a WDS Link

When using WDS, be sure to configure WDS settings on both access points on the WDS link.

For example, to create a WDS link between a pair of access points "MyAP1" and "MyAP2" do the following:

1. Open the Administration Web pages for MyAP1, by entering the IP address for MyAP1 as a URL in the Web browser address bar in the following form:

http://IPAddressOfAccessPoint

where *IPAddressOfAccessPoint* is the address of MyAP1.

2. Navigate to the **WDS** tab on MyAP1 Administration Web pages.

   The MAC address for MyAP1 (the access point you are currently viewing) will show as the **Local Address** at the top of the page.

3. Configure a WDS interface for data exchange with MyAP2.

   Start by entering the MAC address for MyAP2 as the "Remote Address" and fill in the rest of the fields to specify the network (guest or internal), security, and so on. Save the settings (click **Update**).

4. Navigate to the radio settings on the Administration Web pages (**Manage > Radio**) to verify or set the mode and the radio channel on which you want MyAP1 to broadcast.

   Remember that the two access points participating in the link, MyAP1 and MyAP2, must be set to the same Mode and be transmitting on the same channel.

   For our example, let's say we're using IEEE 802.11b Mode and broadcasting on Channel 6. (We'd choose **Mode** and **Channel** from the drop-down menus on the **Radio** tab.)

5. Now repeat the same steps for MyAP2:

   - ☞ Open Administration Web pages for MyAP2 by using MyAP2's IP address in a URL.
   - ☞ Navigate to the WDS tab on MyAP2 Administration Web pages. (MyAP2's MAC address will show as the "Local Address".)
   - ☞ Configure a WDS interface for data exchange with MyAP1, starting with the MAC address for MyAP1.
   - ☞ Navigate to the radio settings for MyAP2 to verify that it is using the same mode and broadcasting on the same channel as MyAP1. (For our example Mode is 802.11b and the channel is 6.)
   - ☞ Be sure to save the settings by clicking **Update**.

Updating Settings

To update WDS settings:

1. Navigate to the **WDS** tab page.
2. Configure the WDS settings as required.
3. Click the **Update** button to apply the changes.

Chapter 21: Configuring Simple Network Management Protocol (SNMP) on the AP

The following sections describe supported SNMP MIBs, and show how to configure SNMP settings on the AT-TQ2403 Management Software:

- Understanding SNMP
- Supported MIBs
- Navigating to SNMP Settings
- Configuring SNMP Settings
    - Configuring SNMP Traps
- Updating SNMP Settings

Understanding SNMP

Simple Network Management Protocol (SNMP) defines a standard for recording, storing, and sharing information about network devices. SNMP facilitates network management, troubleshooting, and maintenance.

Key components of any SNMP-managed network are managed devices, SNMP agents, and a management system. The agents store data about their devices in Management Information Bases (MIBs) and return this data to the SNMP manager when requested. Managed devices can be network nodes such as access point base stations, routers, switches, bridges, hubs, servers, or printers.

The AT-TQ2403 Management Software can function as an SNMP managed device via the supported MIBs for seamless integration into network management systems such as HP OpenView.

The AT-TQ2403 Management Software also supports SNMP traps.

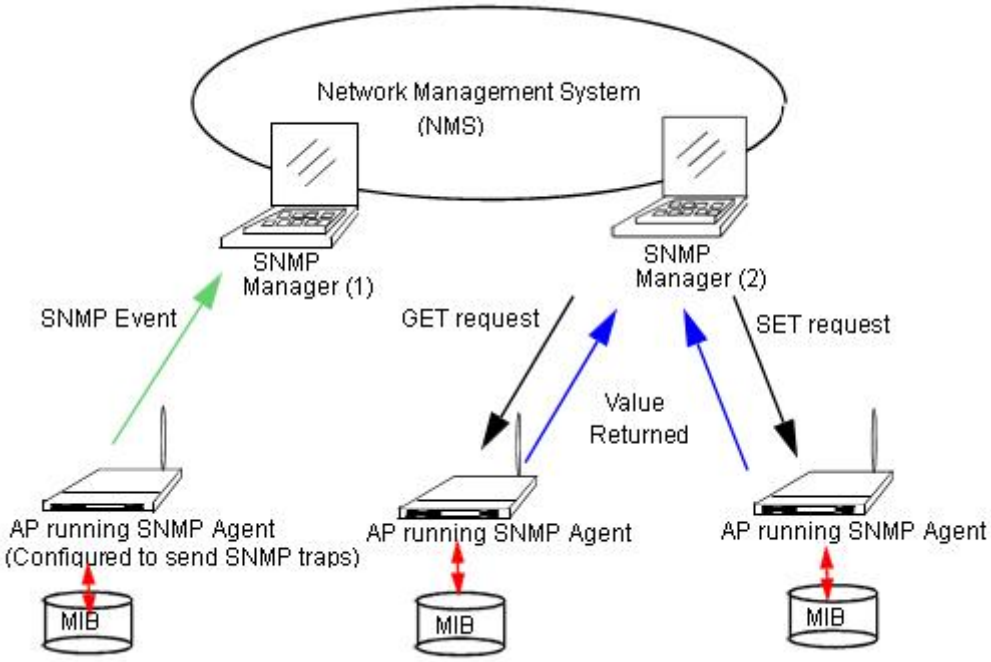


Figure 52: SNMP Setting Diagram

Supported MIBs

MIBs are a collection of objects or files that exist in a virtual database on a network. SNMP uses a specific set of commands and queries to obtain information from the MIB.

The AT-TQ2403 Management Software supports standard and proprietary SNMP MIBs as shown in the following table. The MIB definitions are included with this documentation. If you are viewing this page online, you can click each MIB name to link to the associated MIB definition.

Table Supported MIBs

Category	MIB	Level of Support
Standard IEEE MIB	IEEE802dot11-MIB	Partial support, read-only. The following OIDs are not implemented: WEPKeyMappingsTable GroupAddressesTable ResourceTypeIDName PhyAntennaTable PhyFHSSTable PhyIRTable AntennasList PhyOFDMTable PhyHRDSSSTable HoppingPatternTable

Category	MIB	Level of Support
Standard IEEE MIB	Bridge-MIB	Partial, read-only support including root bridge We do not implement the optional StaticTable. - dot1dStatic - dot1dPortPair The following OIDs are not implemented: - dot1dSr (Because TQ2403 does not support routing function)
Standard IETF MIB	RFC1213-MIB (MIB-II)	Partial support, read-only

Navigating to SNMP Settings

To configure SNMP settings, navigate to **Services > SNMP**, and update the fields as described below.

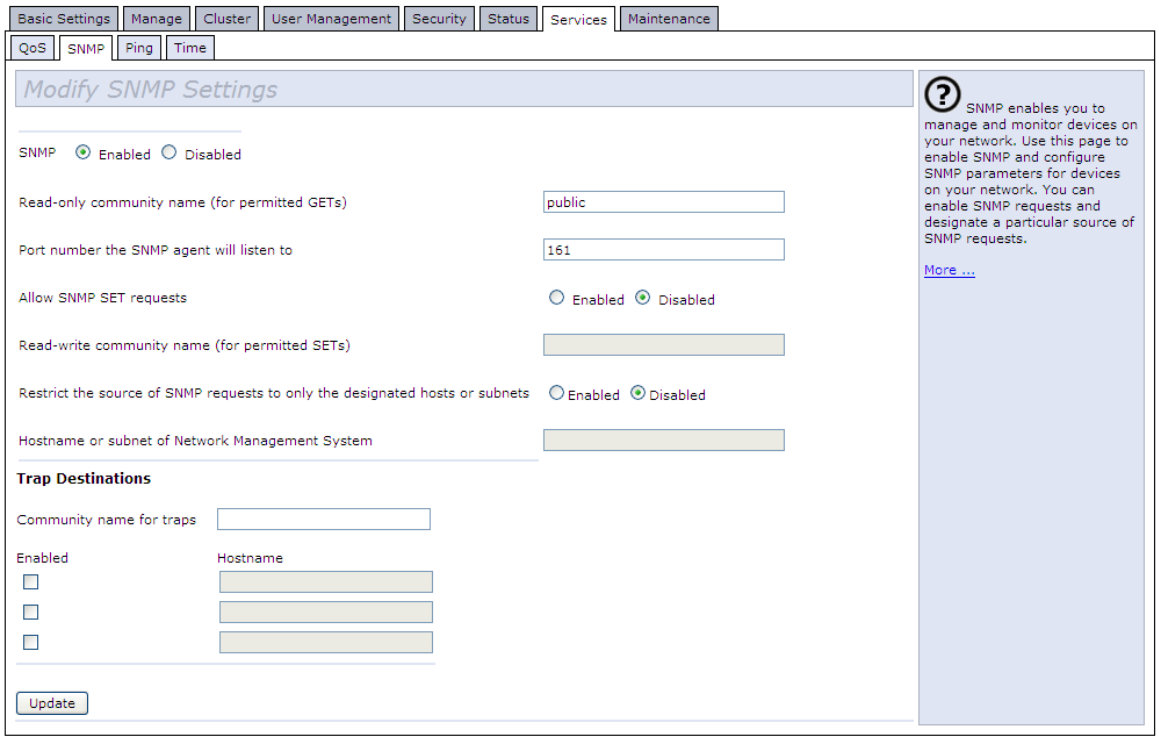


Figure 53: SNMP Setting Page

Configuring SNMP Settings

Start/stop control of SNMP agents, community password configuration, access to MIBs, and configuration of SNMP Trap destinations is provided through the AT-TQ2403 Management Software as described below.

Field	Description
SNMP Enabled/Disabled	You can choose whether or not you want to enable SNMP on your network. By default SNMP is Enabled. • To enable SNMP, click **Enabled**. • To disable SNMP, click **Disabled**. You must click **Update** to save your settings. **Note**: If you do not enable SNMP, all remaining fields on the SNMP page will be disabled.
Read-only community name for permitted GETs	Enter a read-only community name. The community name, as defined in SNMPv2c, acts as a simple authentication mechanism to restrict the machines on the network that can request data to the SNMP agent. The name functions as a password and the request is assumed to be authentic if the sender knows the password. The community name can be in any alphanumeric format.
Port number the SNMP agent will listen to	By default an SNMP agent only listens to requests from port 161. However, you can configure this so the agent listens to requests on another port. Enter the port number on which you want the SNMP agents to listen to requests.
Allow SNMP SET Requests	You can choose whether or not to allow SNMP SET requests. Enabling SET requests means that machines on the network can execute SET requests to the configured agent on the AP. **Note:** SET requests are restricted to the AT-TQ2403 System MIB. • To enable SNMP SET requests, click **Enabled**. • To disable SNMP SET requests, click **Disabled**.
Read-write community name for permitted SETs	If you have enabled SNMP SET requests you can set a read-write community name. Setting a community name is similar to setting a password. Only requests from the machines that identify themselves with this community name will be accepted. The community name can be in any alphanumeric format.

Field	Description
Restrict the source of SNMP requests to only the designated hosts or subnets	You can restrict the source of permitted SNMP requests. • To restrict the source of permitted SNMP requests, click **Enabled**. • To permit any source submitting an SNMP request, click **Disabled**.
Hostname or subnet of Network Management System	Specify the DNS hostname or subnet of the machines that can execute GET and SET requests to the managed devices. As with community names, this provides a level of security on SNMP settings. The SNMP agent will only accept requests from the hostname or subnet specified here. To specify a subnet, enter one or more subnetwork address ranges in the form AddressRange/MaskLength where AddressRange is an IP address and MaskLength is the number of mask bits. Both formats NetAddress/NetMask and NetAddress/MaskLength are supported. Individual hosts can be provided for this, i.e. I.P Address or Hostname. For example, if you enter a range of 192.168.1.0/24 this specifies a subnetwork with address 192.168.1.0 and a subnet mask of 255.255.255.0. The address range is used to specify the subnet of the designated NMS. Only machines with IP addresses in this range are permitted to execute GET and SET requests on the managed device. Given the example above, the machines with addresses from 192.168.1.1 through 192.168.1.254 can execute SNMP commands on the device. (The address identified by suffix .0 in a subnetwork range is always reserved for the subnet address, and the address identified by .255 in the range is always reserved for the broadcast address). As another example, if you enter a range of 10.10.1.128/25 machines with IP addresses from 10.10.1.129 through 10.10.1.254 can execute SNMP requests on managed devices. In this example, 10.10.1.128 is the network address and 10.10.1.255 is the broadcast address. 126 addresses would be designated.

Configuring SNMP Traps

SNMP Traps facilitate asynchronous communication of messages from SNMP managed devices (like the AT-TQ2403 Management Software) to designated hosts. If a Network Management System (NMS) is responsible for monitoring a large number of devices on a network, it is not practical to periodically query every device on the network. By enabling SNMP event traps on the AP, individual devices can send messages directly to SNMP Managers or to other designated hosts on the NMS regarding some network events, such as network interfaces going up or down, clients failing to associate or authenticate with the access point, system power up or down and changes in the network topology.

SNMP traps save on network resources by eliminating redundant SNMP requests. They also make it easier for SNMP Managers to troubleshoot their network. For example, if an SNMP manager is responsible for a large network that supports many devices, and each device has a large number of objects, it is impractical to request information from every object on every device. The optimum solution is for each agent on the managed device to notify the manager of any unusual events. It does this

by sending a trap of the event. After receiving the event information, the manager can choose what action, if any, to take.

Field	Description
Community name for traps	Enter the global community string associated with SNMP traps. Traps sent from the device will provide this string as a community name.
Hostname	Enter the DNS hostname of the computer to which you want to send SNMP traps. Since SNMP traps are sent randomly from the SNMP agent, it makes sense to specify where exactly the traps should be sent. You can configure 3 hostnames in maximum. Ensure you select the **Enabled** checkbox beside the appropriate hostname.

Updating SNMP Settings

To update SNMP settings:

1. Navigate to the **SNMP** tab page.
2. Configure the SNMP settings as required.
3. Click the **Update** button to apply the changes.

Chapter 22: Enabling the Network Time Protocol Server

The Network Time Protocol (NTP) is an Internet standard protocol that synchronizes computer clock times on your network. NTP servers transmit Coordinated Universal Time (UTC, also known as Greenwich Mean Time) to their client systems. NTP sends periodic time requests to servers, using the returned time stamp to adjust its clock.

The timestamp will be used to indicate the date and time of each event in log messages.

See **http://www.ntp.org** for more general information on NTP.

The following sections describe how to configure the AT-TQ2403 Management Software to use a specified NTP server:

- Navigating to Time Protocol Settings
- Enabling or Disabling a Network Time Protocol (NTP) Server
- Updating Settings

Navigating to Time Protocol Settings

To enable an NTP server, navigate to the **Services > Time** tab, and update the fields as described below.

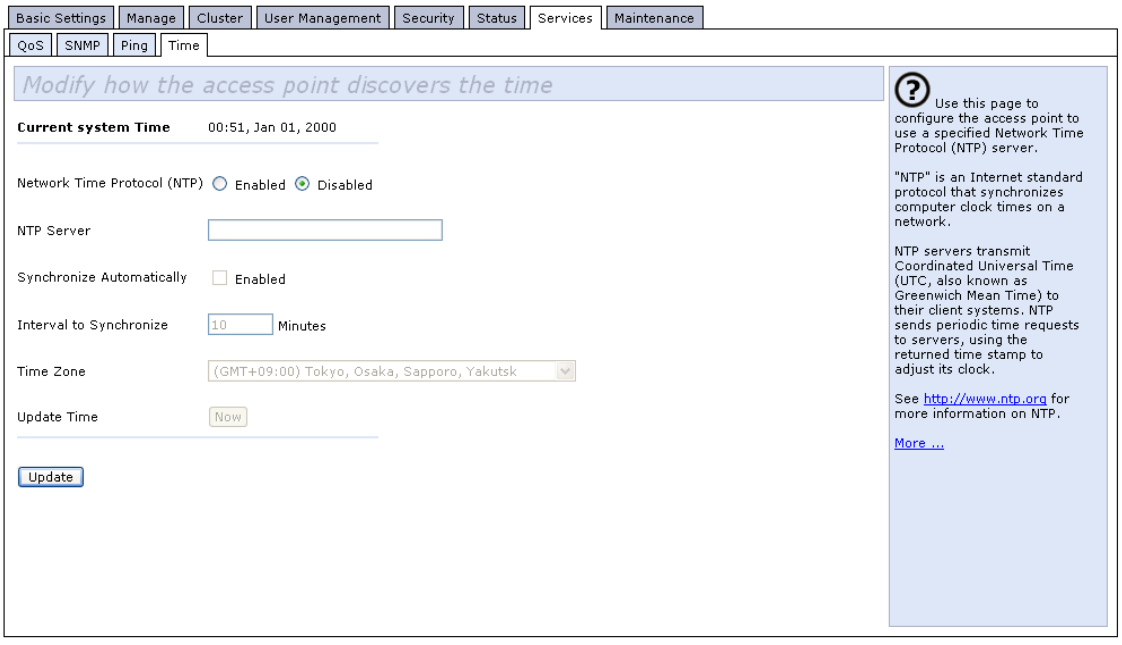


Figure 54: Time Setting Page

Enabling or Disabling a Network Time Protocol (NTP) Server

To configure your access point to use a network time protocol (NTP) server, first enable the use of NTP, and then select the NTP server you want to use. (To shut down NTP service on the network, disable NTP on the access point.)

Field	Description
Network Time Protocol (NTP)	NTP provides a way for the access point to obtain and maintain its time from a server on the network. Using an NTP server gives your AP the ability to provide the correct time of day in log messages and session information. For more information on NTP, see **http://www.ntp.org.** Choose to either enable or disable use of a network time protocol (NTP) server: • To enable the NTP server, click **Enabled**. • To disable the NTP server, click **Disabled**.
NTP Server	If NTP is enabled, select the NTP server you want to use. You can specify the NTP server by host name or IP address, although using the IP address is not recommended as these can change more readily.
Synchronize Automatically	If enabled, the device will synchronize time with NTP server automatically.
Interval to Synchronize	If Synchronize Automatically is enabled, the device will synchronize time with the NTP server at each specified interval. The interval is set in minutes.
Time zone	Specify the time zone where the device locates. The time zone determines the local time when the device is synchronizing time with the NTP server.
Update Time	After **Now** is clicked, your setting will be submitted and the device will synchronize time with the NTP server immediately.

Updating Settings

To update time settings:

1. Navigate to the **Time** tab page.
2. Configure the time settings as required.
3. Click the **Update** button to apply the changes.

Chapter 23: Backing up and Restoring a Configuration

You can save a copy of the current settings on the AT-TQ2403 Management Software to a backup configuration file. The backup file can be used at a later date to restore the access point to the previously saved configuration.

The following topics describe how to back up and restore access point configurations:

- Navigating to the Access Point's Configuration Settings
- Resetting Factory Default Configuration
- Saving the Current Configuration to a Backup File
- Restoring the Configuration from a Previously Saved File
- Rebooting the Access Point
- Upgrading the Firmware

Navigating to the Access Point's Configuration Settings

To manage the configuration of an access point, navigate to the **Maintenance > Configuration** tab and use the interface as described below.

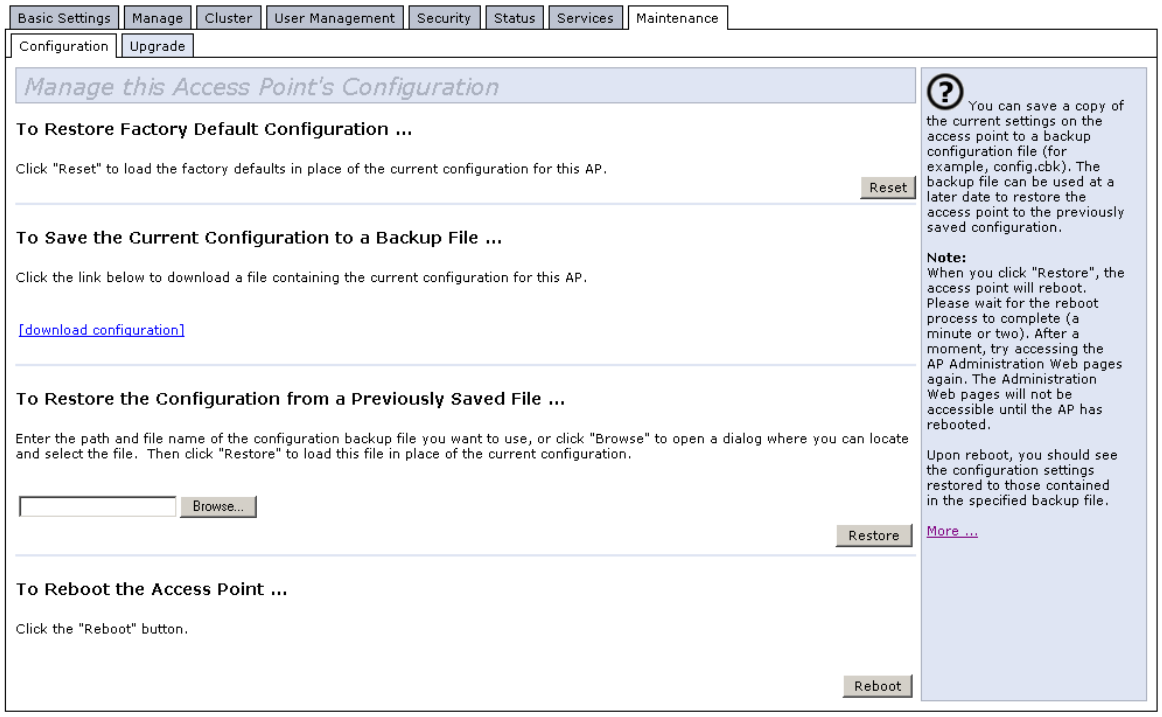


Figure 55: Configuration Page

Resetting Factory Default Configuration

If you are experiencing problems with the AT-TQ2403 Management Software and have tried all other troubleshooting measures, use the Reset Configuration function. This will restore factory defaults and clear all settings, including settings such as a new password or wireless settings.

1. Click the **Maintenance > Configuration** tab.

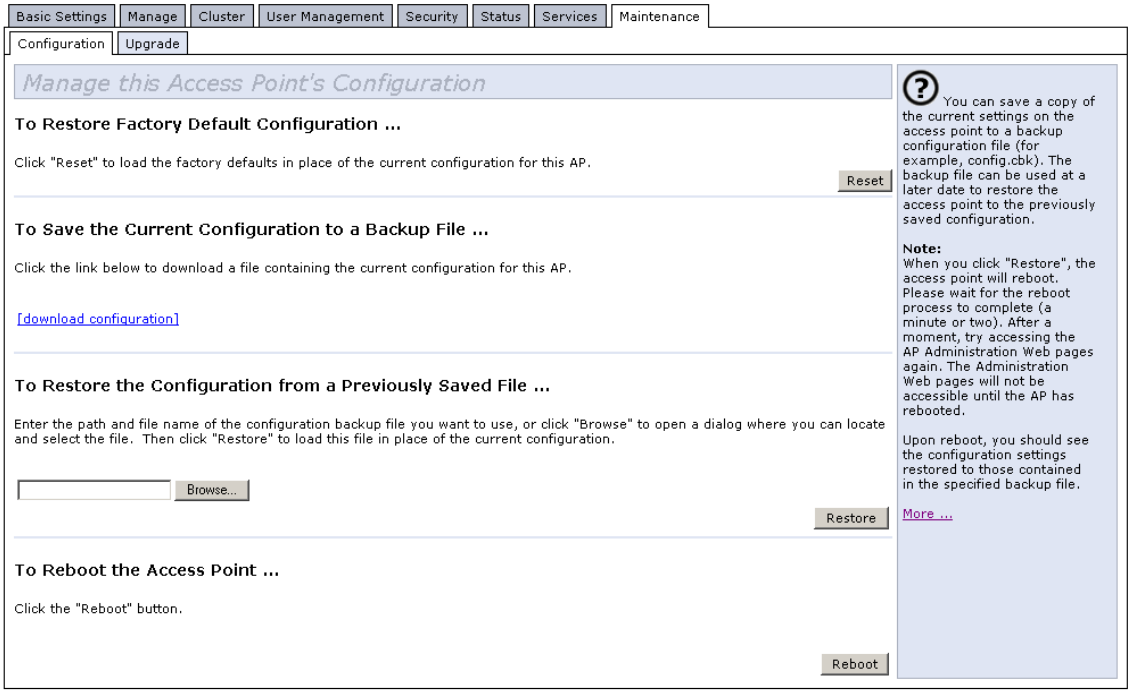


Figure 56: Configuration Setting Detail

2. Click the **Reset** button.

   Factory defaults are restored.

Note: Keep in mind that if you do reset the configuration from this page, you are doing so for this access point only; not for other access points in the cluster.

Saving the Current Configuration to a Backup File

To save a copy of the current settings on an access point to a backup configuration file (.cbk format):

1. Click the **download configuration** link.

   A File Download or Open dialog is displayed.

2. Choose the **Save** option on this first dialog.

   This brings up a file browser.

3. Use the file browser to navigate to the directory where you want to save the file, and click **OK** to save the file.

You can keep the default file name (config.cbk) or rename the backup file, but be sure to save the file with a **.cbk** extension.

Restoring the Configuration from a Previously Saved File

To restore the configuration on an access point to previously saved settings:

1. Select the backup configuration file you want to use, either by typing the full path and file name in the Restore textbox or click **Browse** and select the file.

   (Only those files that were created with the Backup function and saved as .cbk backup configuration files are valid to use with Restore; for example, apconfig.cbk)

2. Click the **Restore** button.

   The access point will reboot.

Note: When you click **Restore**, the access point will reboot. A "reboot" confirmation dialog and follow-on "rebooting" status message will be displayed. Please wait for the reboot process to complete (a minute or two). After a moment, try accessing the Administration Web pages as described in the next step; they will not be accessible until the AP has rebooted.

When the access point has rebooted, access the Administration Web pages either by clicking again on one of the tabs (if the UI is still displayed) or by typing the IP address of the access point into your browser. Now you should see the configuration settings restored to the original settings you retrieved from the Backup file.

Rebooting the Access Point

For maintenance purposes or as a troubleshooting measure, you can reboot the AT-TQ2403 Management Software as follows.

1. Click the **Maintenance > Configuration** tab.

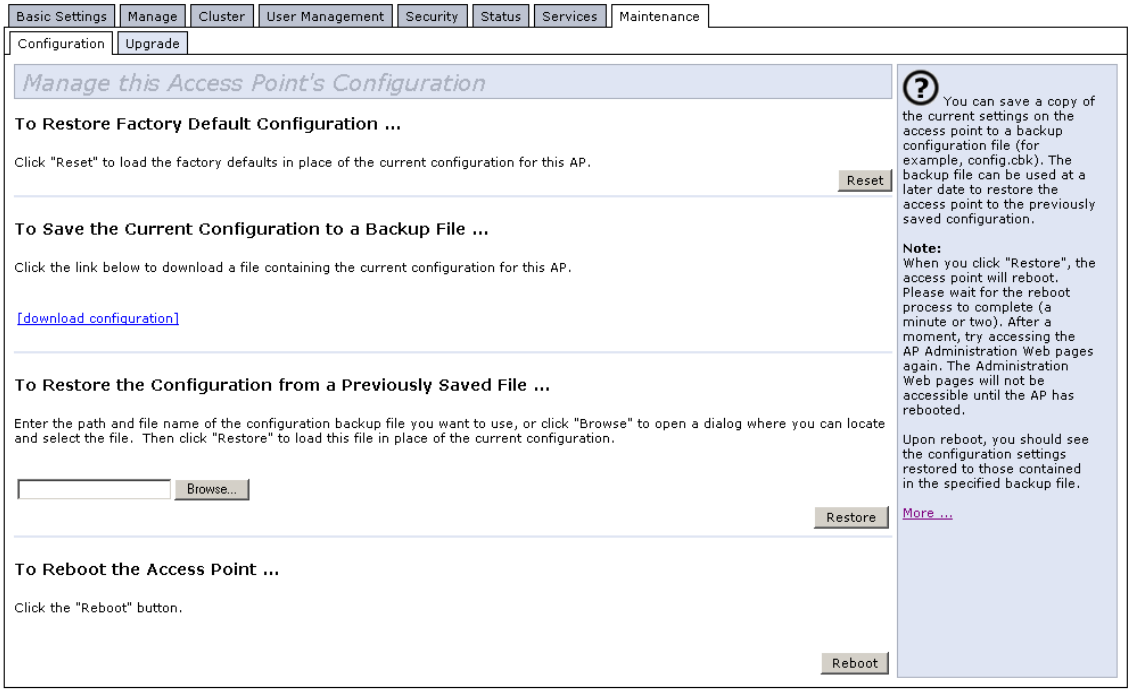


Figure 57: Configuration Setting Page

2. Click the **Reboot** button.

   The AP will reboot.

Upgrading the Firmware

As new versions of the AT-TQ2403 Management Software firmware become available, you can upgrade the firmware on your devices to take advantages of new features and enhancements.

Caution:

It is strongly recommended that **do not** upgrade the firmware from a wireless client that is associated with the access point you are upgrading. Doing so will possibly cause the upgrade to fail. Furthermore, all wireless clients will be disassociated and no new associations will be allowed.

To upgrade, please use a wired client to gain access to the access point:

- Create a wired Ethernet connection from a PC to the access point.
- Bring up the Administration UI

Repeat the upgrade process using with the wired client.

For firmware downgrades, the AP is set back to the factory defaults. To guard against losing a configuration because of a firmware downgrade, you should first save backups of current configurations per the instructions in "Saving the Current Configuration to a Backup File".

To upgrade the firmware on a particular access point:

1. Navigate to **Maintenance > Upgrade** on the Administration Web pages for that access point.

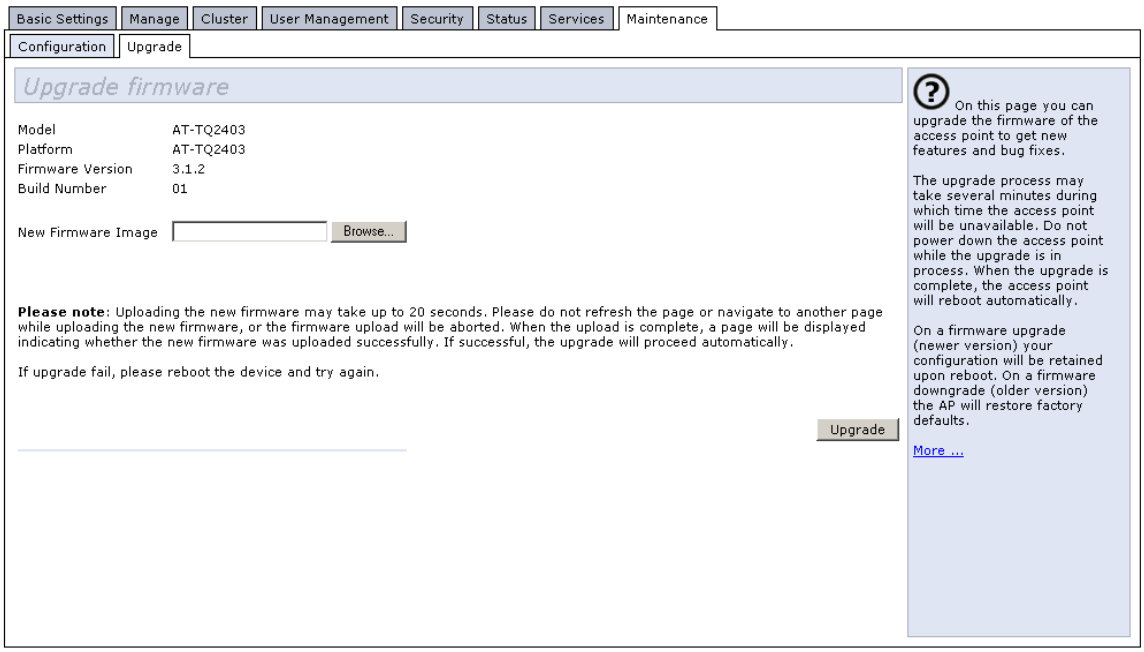


Figure 58: Upgrade Page

Information about the current firmware version is displayed and an option to upgrade a new firmware image is provided.

2. If you know the path to the New Firmware Image file, enter it in the **New Firmware Image** textbox. Otherwise, click the **Browse** button and locate the firmware image file.

Update

1. Click **Update** to apply the new firmware image.

   Upon clicking **Update** for the firmware upgrade, a popup confirmation window is displayed that describes the upgrade process.

2. Click **OK** to confirm the upgrade, and start the process.

⚠ **Caution:** The firmware upgrade process begins once you click **Update** and then **OK** in the popup confirmation window. The upgrade process may take several minutes during which time the access point will be unavailable. Do not power down the access point while the upgrade is in process. When the upgrade is complete, the access point will restart and resume normal operation.

Verifying the Firmware Upgrade

To verify that the firmware upgrade completed successfully, check the firmware version shown on the Upgrade tab (and also on the **Basic Settings** tab). If the upgrade was successful, the updated version name or number will be indicated.

Appendix A: Security Settings on Wireless Clients and RADIUS Server Setup

Typically, users will configure security on their wireless clients for access to many different networks (access points). The list of "Available Networks" will change depending on the location of the client and which APs are online and detectable in that location. Once an AP has been detected by the client and security is configured for it, it remains in the client's list of networks but shows as either reachable or unreachable depending on the situation. For each network (AP) you want to connect to, configure security settings on the client to match the security mode being used by that network.

We describe security setup on a client that uses Microsoft Windows client software for wireless connectivity. The Windows client software is used as the example because of its widespread availability on Windows computers and laptops. These procedures will vary slightly if you use different software on the client (such as Funk Odyssey), but the configuration information you need to provide is the same.

Note: The recommended sequence for security configuration is (1) set up security on the access point, and (2) configure security on each of the wireless clients.

We expect that initially, you will connect to an access point that has no security set (None) from an unsecure wireless client. With this initial connection, you can go to the access point Administration Web pages and configure a security mode (Security).

When you re-configure the access point with a security setting and click "**Update**", your wireless client will be disassociated and you will lose connectivity to the AP Administration Web pages. In some cases, you may need to make additional changes to the AP security settings before configuring the client. Therefore, you must have a backup Ethernet (wired) connection.

The following sections describe how to set up each of the supported security modes on wireless clients of a network served by the AT-TQ2403 Management Software.

- Network Infrastructure and Choosing Between Built-in or External Authentication Server
- Make Sure the Wireless Client Software is Up-to-Date
- Accessing the Microsoft Windows Wireless Client Security Settings
- Configuring a Client to Access an Unsecure Network (No Security)
- Configuring Static WEP Security on a Client
- Configuring IEEE 802.1x Security on a Client
- Configuring WPA/WPA2 Enterprise (RADIUS) Security on a Client
- Configuring WPA/WPA2 Personal (PSK) Security on a Client
- Configuring an External RADIUS Server to Recognize the AT-TQ2403 Management Software
- Obtaining a TLS-EAP Certificate for a Client
- Configuring RADIUS Server for VLAN tags

Network Infrastructure and Choosing Between Built-in or External Authentication Server

Network security configurations including Public Key Infrastructures (PKI), Remote Authentication Dial-in User Server (RADIUS) servers, and Certificate Authority (CA) can vary a great deal from one organization to the next in terms of how they provide Authentication, Authorization, and Accounting (AAA). Ultimately, the particulars of your infrastructure will determine how clients should configure security to access the wireless network. Rather than try to predict and address the details of every possible scenario, this document provides general guidelines about each type of client configuration supported by the AT-TQ2403 Management Software.

I Want to Use the Built-in Authentication Server (EAP-PEAP)

If you do not have a RADIUS server or PKI infrastructure in place and/or are unfamiliar with many of these concepts, we strongly recommend setting up the AT-TQ2403 Management Software with security that uses the Built-in Authentication Server on the AP. This will mean setting up the AP to use either IEEE 802.1x or WPA/WPA2 Enterprise (RADIUS) security mode. (The built-in authentication server uses EAP-PEAP authentication protocol.)

- If the AT-TQ2403 Wireless Access Point is set up to use IEEE 802.1x mode and the Built-in Authentication Server, then configure wireless clients as described in "IEEE 802.1x Client Using EAP/PEAP".

- If the AT-TQ2403 Wireless Access Point is configured to use WPA/WPA2 Enterprise (RADIUS) mode and the Built-in Authentication Server, configure wireless clients as described in "WPA/WPA2 Enterprise (RADIUS) Client Using EAP/PEAP".

I Want to Use an External RADIUS Server with EAP-TLS Certificates or EAP-PEAP

We make the assumption that if you have an external RADIUS server and PKI/CA setup, you will know how to configure client security options appropriate to your security infrastructure beyond the fundamental suggestions given here. Topics covered here that particularly relate to client security configuration in a RADIUS - PKI environment are:

- "IEEE 802.1x Client Using EAP/TLS Certificate".

- "WPA/WPA2 Enterprise (RADIUS) Client Using EAP-TLS Certificate".

- "Configuring an External RADIUS Server to Recognize the AT-TQ2403 Wireless Access Point".

- "Obtaining a TLS-EAP Certificate for a Client".

Details on how to configure an EAP-PEAP client with an external RADIUS server are not covered in this document.

Make Sure the Wireless Client Software is Up-to-Date

Before starting out, please keep in mind that service packs, patches, and new releases of drivers and other supporting technologies for wireless clients are being generated at a fast pace. A common problem encountered in client security setup is not having the right driver or updates to it on the client. For example; if you are setting up WPA on the client, make sure you have a driver installed that supports WPA, which is a relatively new technology. Even many client cards currently available do not ship from the factory with the latest drivers.

Accessing the Microsoft Windows Wireless Client Security Settings

Generally, on Windows XP there are two ways to get to the security properties for a wireless client:

1. From the wireless connection icon on the Windows task bar:

   ☞ Right-click on the Wireless connection icon in your Windows task bar and select **View available wireless networks**.

   ☞ Select the SSID of the network to which you want to connect and click **Advanced** to bring up the Wireless Network Connection Properties dialog.

Or

2. From the Windows Start menu at the left end of the task bar:

   ☞ From the Windows Start menu on the task bar, choose **Start > My Network Places** to bring up the Network Connections window.

   ☞ From the Network Tasks menu on the left, click **View Network Connections** to bring up the Net- work Connections window.

   ☞ Select the Wireless Network Connection you want to configure, right-mouse click and choose **View available wireless networks**.

   ☞ Select the SSID of the network to which you want to connect and click **Advanced** to bring up the Wireless Network Connection Properties dialog.

The Wireless Networks tab (which should be automatically displayed) lists Available networks and Preferred networks.

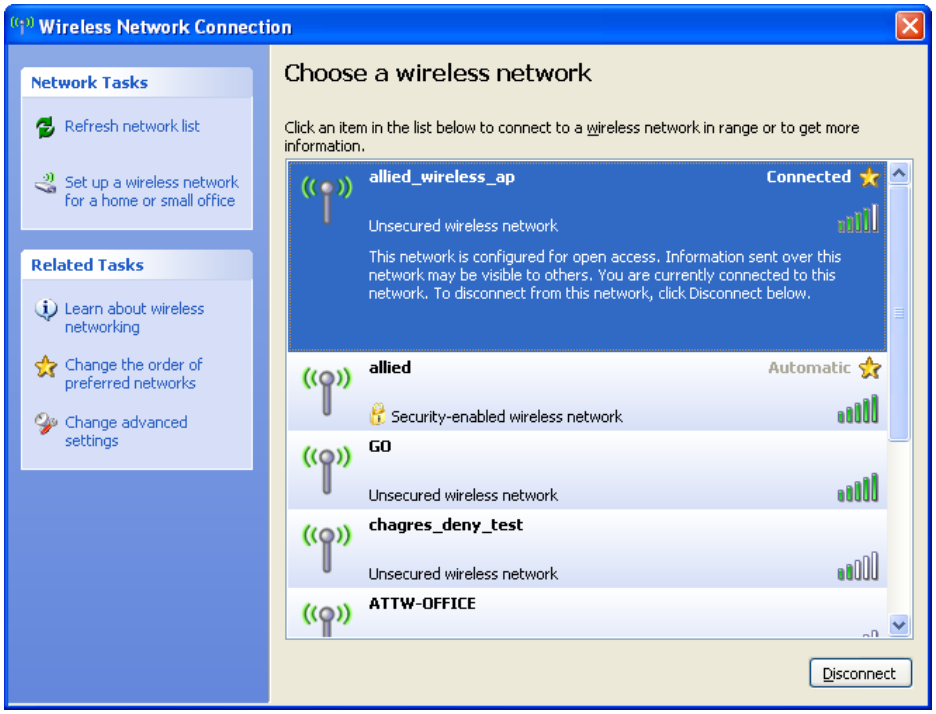


Figure 59: Wireless Network Connection Page

List of available networks will change depending on client location. Each network (or access point) that that is detected by the client shows up in this list. ("**Refresh**" updates the list with current information.)

For each network you want to connect to, configure security settings on the client to match the security mode being used by that network.

Note: The exception to this is if the AP is configured to prohibit broadcast of its network name, the name will not show on this list. In that case you would need to type in the exact network name to be able to connect to it.

---

3. From the list of "Available networks", select the SSID of the network to which you want to connect and click **Configure**.

This brings up the Wireless Network Connection Properties dialog with the Association and Authentication tabs for the selected network.

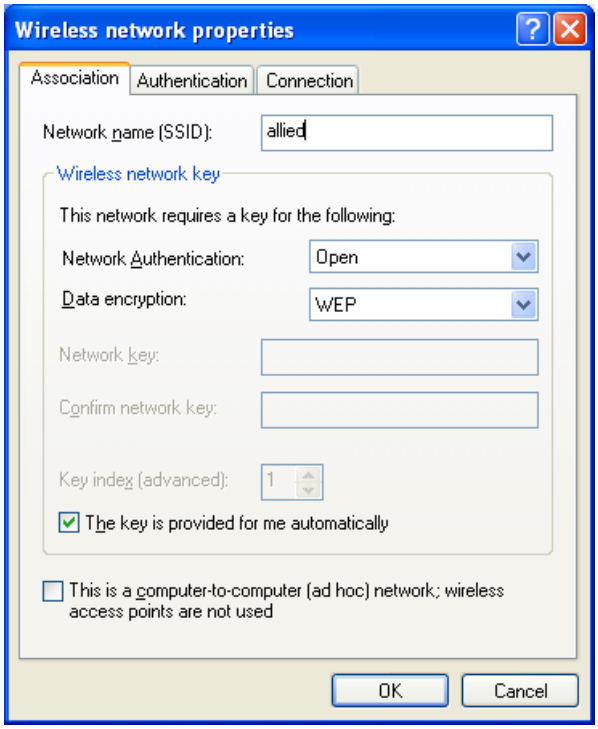


Figure 60: Wireless Network Connection Properties Page

Use this dialog for configuring all the different types of client security described in the following sections. Make sure that the Wireless Network Properties dialog you are working in pertains to the Network Name (SSID) for the network you want to reach on the wireless client you are configuring.

Configuring a Client to Access an Unsecure Network (No Security)

If the access point or wireless network to which you want to connect is configured as "None", that is, no security, you need to configure the client accordingly. A client using no security to connect is configured with Network Authentication "Open" to that network and Data Encryption "Disabled" as described below.

If you do have security configured on a client for properties of an unsecure network, the security settings actually can prevent successful access to the network because of the mismatch between client and access point security configurations.

To configure the client to not use any security, bring up the client Network Properties dialog and configure the following settings.

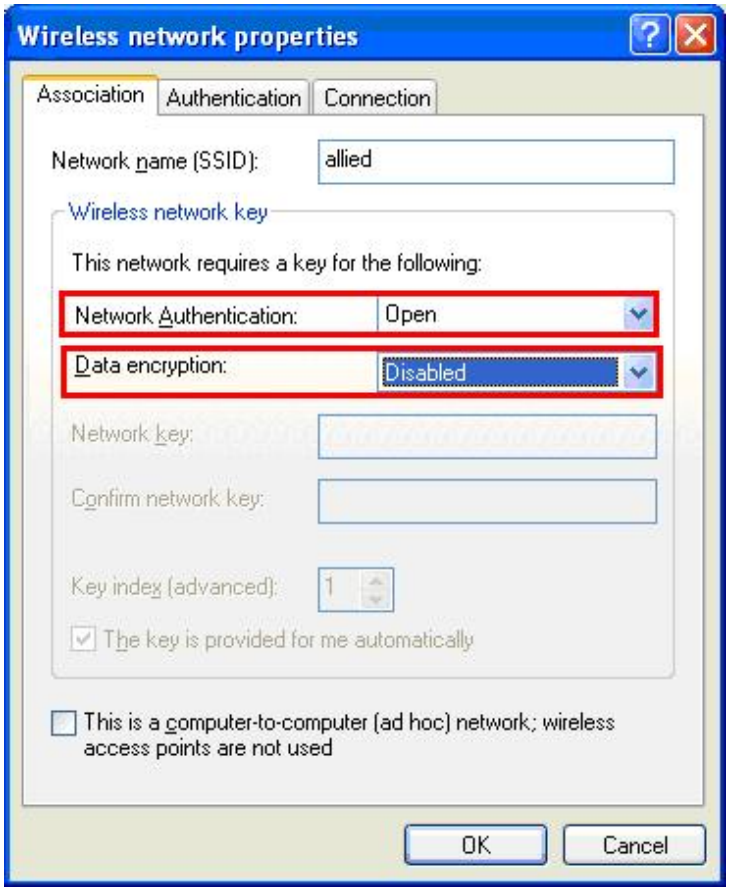


Figure 61: Wireless Network Connection Properties Setting – No Security Setting Association Tab

Field	Setting
Network Authentication	Open
Data Encryption	Disabled

Configuring Static WEP Security on a Client

Static Wired Equivalent Privacy (WEP) encrypts data moving across a wireless network based on a static (non-changing) key. The encryption algorithm is a "stream" cipher called RC4. The access point uses a key to transmit data to the client stations. Each client must use that same key to decrypt data it receives from the access point. Different clients can use different keys to transmit data to the access point. (Or they can all use the same key, but this is less secure because it means one station can decrypt the data being sent by another.)

If you configured the AT-TQ2403 Wireless Access Point to use Static WEP security mode…

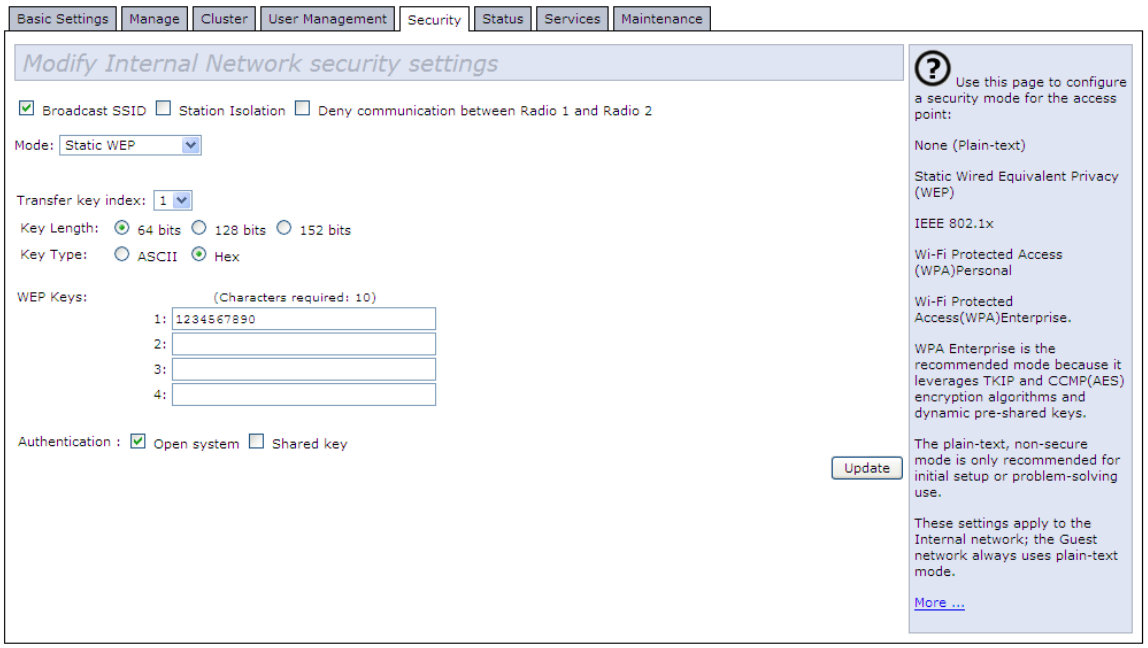


Figure 62: Security Setting Page – Static WEP Setting Page

. . . then configure WEP security on each client as follows.

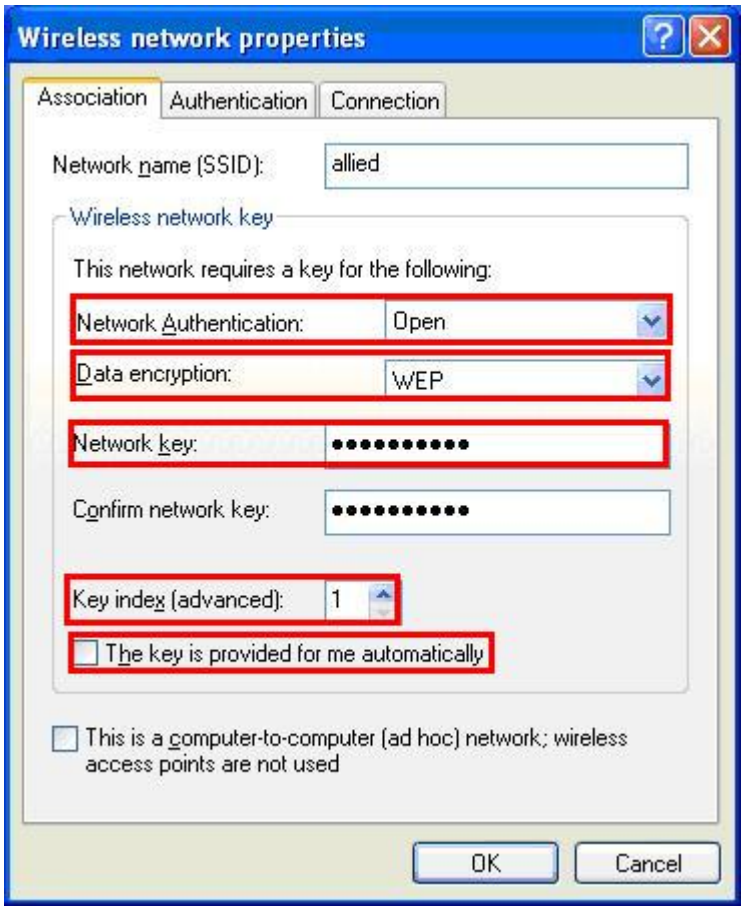


Figure 63: Client Side Security Setting - Static WEP Setting Detail Association Tab

Field	Setting
Network Authentication	"Open" or "Shared", depending on how you configured this option on the access point. **Note**: When the Authentication Algorithm on the access point is set to "Both", clients set to either Shared or Open can associate with the AP. Clients configured to use WEP in Shared mode must have a valid WEP key in order to associate with the AP. Clients configured to use WEP as an Open system can associate with the AP even without a valid WEP key (but a valid key will be required to actually view and exchange data). For more information, see Administrators Guide and Online Help on the access point.
Data Encryption	WEP
Network Key	Provide the WEP key you entered on the access point Security settings in the Transfer Key Index position. For example, if the Transfer Key Index on the access point is set to "1", then for the client Network Key specify the WEP Key you entered as WEP Key 1 on the access point.
Key Index	Set key index to indicate which of the WEP keys specified on the access point Security page will be used to transfer data from the client back to the access point. For example, you can set this to 1, 2, 3, or 4 if you have all four WEP keys configured on the access point.
The Key is provided for me automatically	Disable this option (click to uncheck the box)
Enable IEEE 802.1x authentication for this network	Make sure that IEEE 802.1x authentication is **disabled (box should be unchecked)**. (Setting the encryption mode to WEP should automatically disable authentication.)

Click **OK** on the Wireless Network Properties dialog to close it and save your changes.

Connecting to the Wireless Network with a Static WEP Client

Static WEP clients should now be able to associate and authenticate with the access point. As a client, you will not be prompted for a WEP key. The WEP key configured on the client security settings is automatically used when you connect.

Configuring IEEE 802.1x Security on a Client

IEEE 802.1x is the standard defining port-based authentication and infrastructure for doing key management. Extensible Authentication Protocol (EAP) messages sent over an IEEE 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). IEEE 802.1x provides dynamically-generated keys that are periodically refreshed. An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each 802.11 frame.

IEEE 802.1x Client Using EAP/PEAP

The Built-In Authentication Server on the AT-TQ2403 Management Software uses Protected *Extensible Authentication Protocol* (EAP) referred to here as "EAP/PEAP".

- If you are using the Built-in Authentication server with "IEEE 802.1x" Security mode on the AT-TQ2403 Wireless Access Point, then you will need to set up wireless clients to use PEAP.
- Additionally, you may have an external RADIUS server that uses EAP/PEAP. If so, you will need to (1) add the AT-TQ2403 Wireless Access Point to the list of RADIUS server clients, and (2) configure your IEEE 802.1x wireless clients to use PEAP.

Note: The following example assumes you are using the Built-in Authentication server that comes with the AT-TQ2403 Wireless Access Point. If you are setting up EAP/PEAP on a client of an AP that is using an external RADIUS server, the client configuration process will differ somewhat from this example especially with regard to certificate validation.

If you configured the AT-TQ2403 Wireless Access Point to use IEEE 802.1x security mode . . .

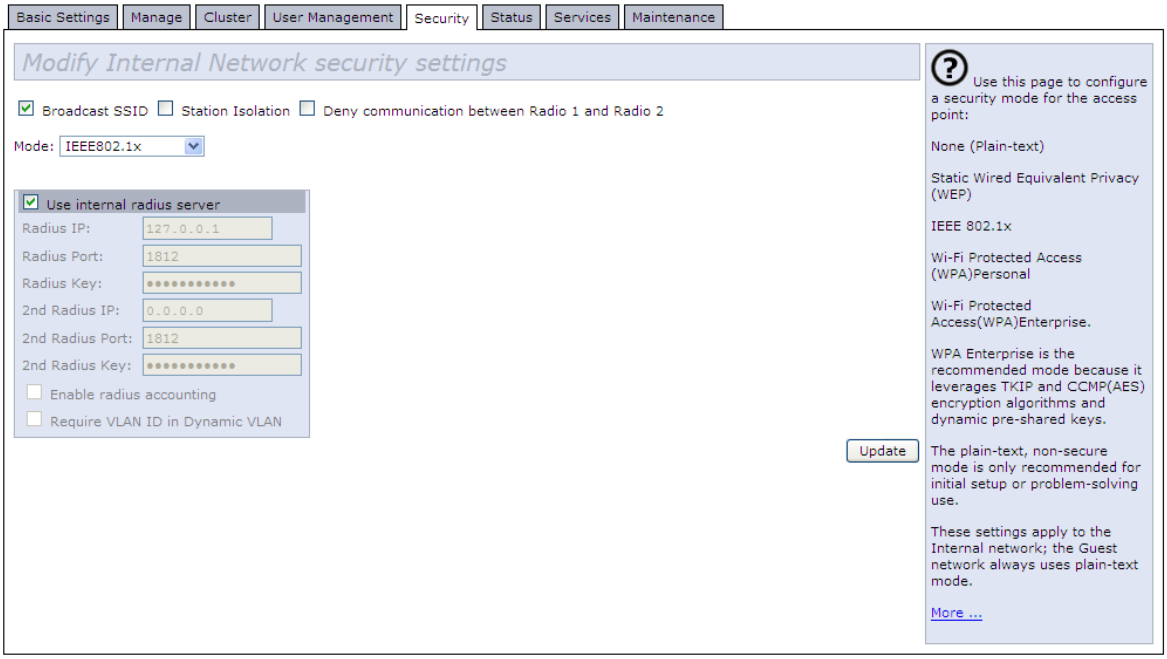


Figure 64: Security Setting Page – IEEE802.1x Setting Page

. . . then configure IEEE 802.1x security with PEAP authentication on each client as follows.

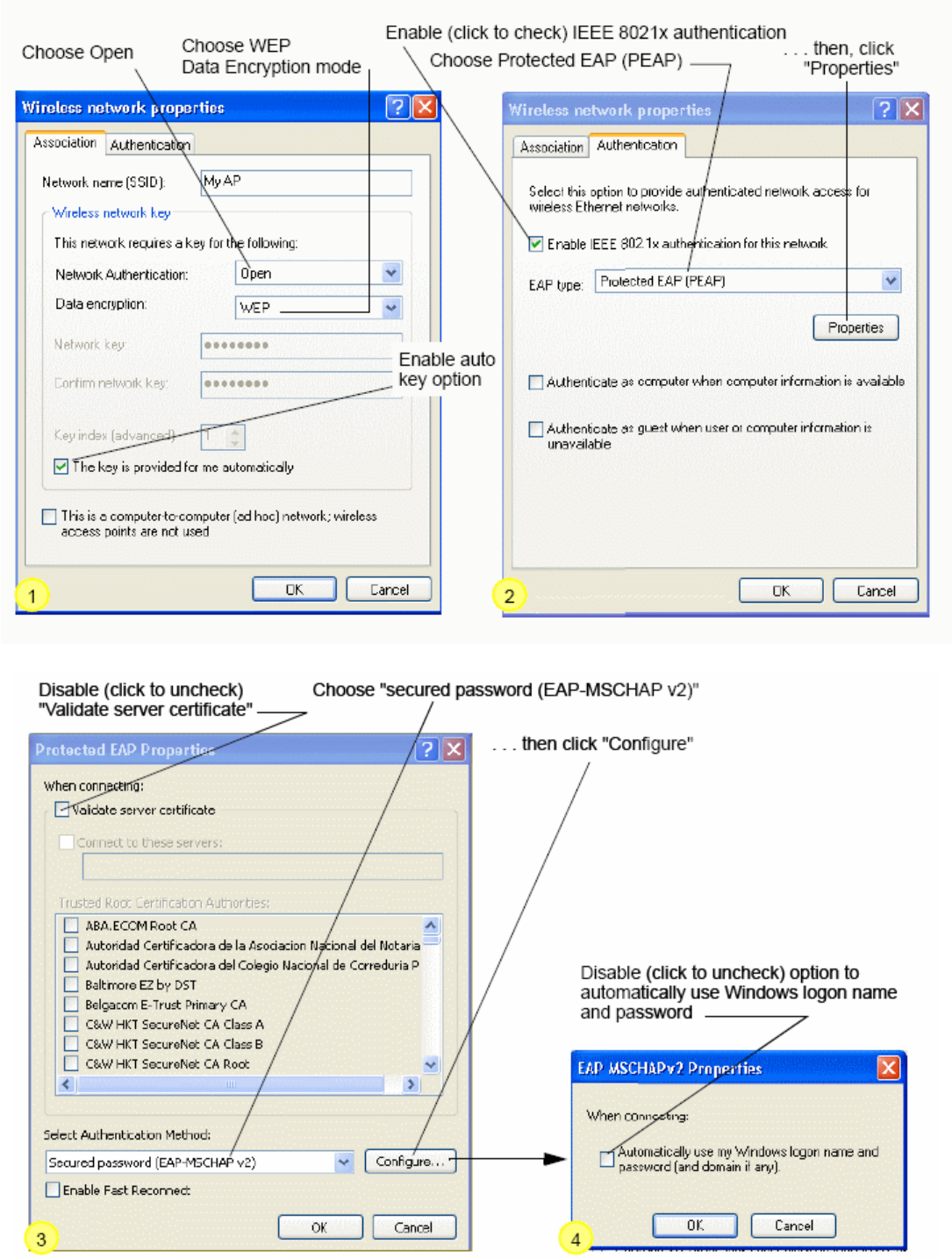


Figure 65: Client Side Security Setting - IEEE802.1x Security Setting Detail

1. Configure the following settings on the Association tab on the Network Properties dialog.

Association Tab

Field	Setting
Network Authentication	Open
Data Encryption	WEP **Note:** An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each IEEE 802.11 frame. This is the same encryption algorithm as is used for Static WEP; therefore, the data encryption method configured on the client for this mode is WEP.
This key is provided for me automatically	Enable (click to check) this option.

2. Configure this setting on the Authentication tab.

Authentication Tab

Field	Setting
EAP Tye	Choose "Protected EAP (PEAP)".

3. Click **Properties** to bring up the Protected EAP Properties dialog and configure the following settings.

Authentication Tab

Field	Setting
Validate Server Certificate	Disable this option (click to uncheck the box). **Note**: This example assumes you are using the Built-in Authentication server on the AP. If you are setting up EAP/PEAP on a client of an AP that is using an external RADIUS server, you might certificate validation and choose a certificate, depending on your infrastructure.
Select Authentication Method	Choose "Secured password (EAP-MSCHAP v2)"

4. Click **Configure** to bring up the EAP MSCHAP v2 Properties dialog.

   On this dialog, disable (click to uncheck) the option to "Automatically use my Windows login name . . ." etc.

   Click **OK** on all dialogs (starting with the EAP MSCHAP v2 Properties dialog) to close and save your changes.

Logging on to the Wireless Network with an IEEE 802.1x PEAP Client

IEEE 802.1x PEAP clients should now be able to associate with the access point. Client users will be prompted for a user name and password to authenticate with the network.

IEEE 802.1x Client Using EAP/TLS Certificate

Extensible Authentication Protocol (EAP) Transport Layer Security (TLS), or EAP-TLS, is an authentication protocol that supports the use of smart cards and certificates. You have the option of using EAP-TLS with both WPA/WPA2 Enterprise (RADIUS) and IEEE 802.1x modes if you have an external RADIUS server on the network to support it.

Note: If you want to use IEEE 802.1x mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a *Public Key Authority Infrastructure* (PKI), including a *Certificate Authority* (CA), server configured on your network. It is beyond the scope of this document to describe these configurations of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

Some good starting points available on the Web for the Microsoft Windows PKI software are: "How to Install/Uninstall a Public Key Certificate Authority for Windows 2000" at http://support.microsoft.com/default.aspx?scid=kb;EN-US;231881

and How to Configure a Certificate Server at http://support.microsoft.com/default.aspx?scid=kb;en-us;318710#3

To use this type of security, you must do the following:

1. Add the AT-TQ2403 Wireless Access Point to the list of RADIUS server clients. (See "Configuring an External RADIUS Server to Recognize the AT-TQ2403 Wireless Access Point".)

2. Configure the AT-TQ2403 Wireless Access Point to use your RADIUS server (by providing the RADIUS server IP address as part of the "IEEE 802.1x" security mode settings).

3. Configure wireless clients to use IEEE 802.1x security and "Smart Card or other Certificate" as described in this section.

4. Obtain a certificate for this client as described in "Obtaining a TLS-EAP Certificate for a Client".

   If you configured the AT-TQ2403 Wireless Access Point to use IEEE 802.1x security mode with an external RADIUS server…

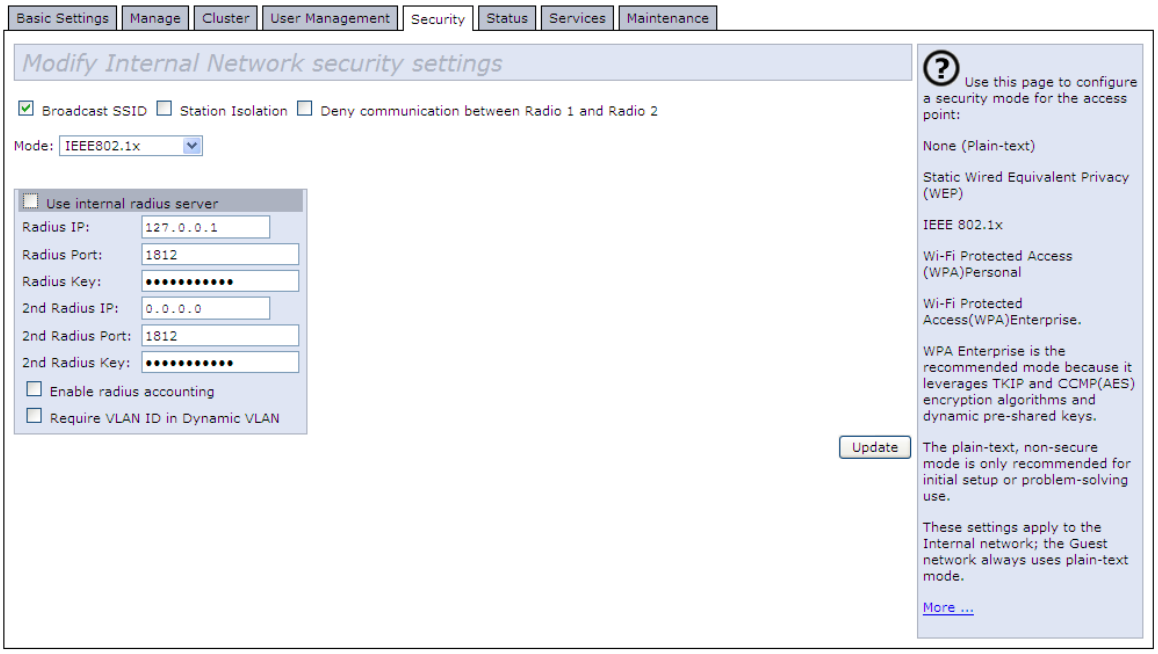


Figure 66: Security Setting Page – IEEE802.1x Setting Page

. . . then configure IEEE 802.1x security with certificate authentication on each client as follows.

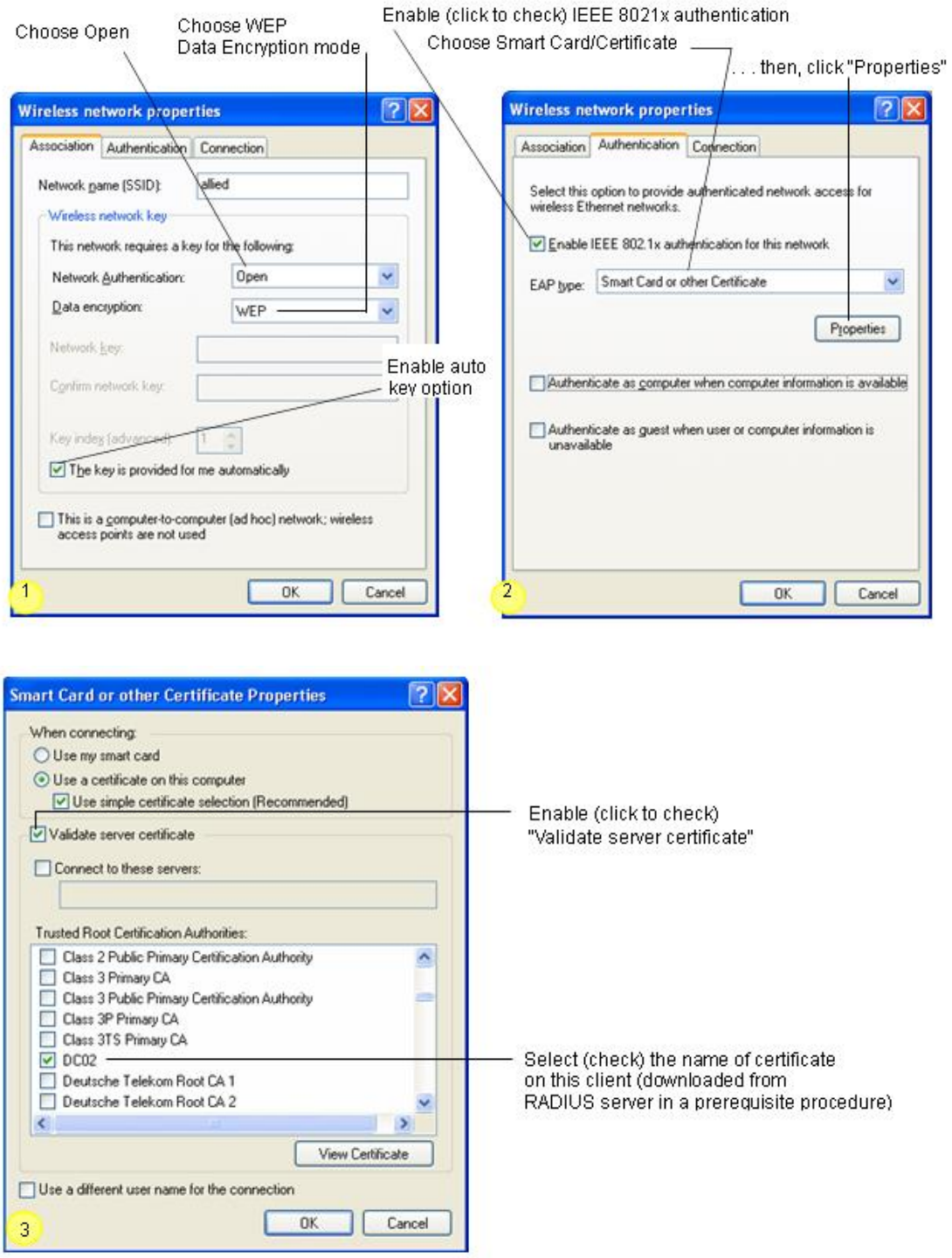


Figure 67: Client Side Security Setting - IEEE802.1x Security Setting Detail

1. Configure the following settings on the Association tab on the Network Properties dialog.

Association Tab

Field	Setting
Network Authentication	Open
Data Encryption	WEP **Note**: An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each IEEE 802.11 frame. This is the same encryption algorithm as is used for Static WEP; therefore, the data encryption method configured on the client for this mode is WEP.
This key is provided for me automatically	Enable (click to check) this option.

2. Configure these settings on the Authentication tab.

Authentication Tab

Field	Setting
Enable IEEE 802.1x authentication for this network	Enable (click to check) this option.
EAP Type	Choose Smart Card or other Certificate

3. Click **Properties** to bring up the Smart Card or other Certificate Properties dialog and enable the "Validate server certificate" option.

Smart Card or other Certificate Properties Dialog

Field	Setting
Validate Server Certificate	Enable this option (click to check the box).
Certificates	In the certificate list shown, select the certificate for this client.

Click **OK** on all dialogs to close and save your changes.

4. To complete the client configuration you must now obtain a certificate from the RADIUS server and install it on this client. For information on how to do this see "Obtaining a TLS-EAP Certificate for a Client".

Connecting to the Wireless Network with an IEEE 802.1x Client Using a Certificate

IEEE 802.1x clients should now be able to connect to the access point using their TLS certificates. The certificate you installed is used when you connect, so you will not be prompted for login information. The certificate is automatically sent to the RADIUS server for authentication and authorization.

Configuring WPA/WPA2 Enterprise (RADIUS) Security on a Client

Wi-Fi Protected Access 2 (WPA2) with *Remote Authentication Dial-In User Service* (RADIUS) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes *Advanced Encryption Standard* (AES), *Counter mode/CBC-MAC Protocol* (CCMP), and *Temporal Key Integrity Protocol* (TKIP) mechanisms. This mode requires the use of a RADIUS server to authenticate users.

This security mode also provides backwards-compatibility for wireless clients that support only the original WPA.

When you configure WPA/WPA2 Enterprise (RADIUS) security mode on the access point, you have a choice of whether to use the Built-in Authentication Server or an external RADIUS server that you provide.

The AT-TQ2403 Wireless Access Point Built-in Authentication Server supports Protected *Extensible Authentication Protocol* (EAP) known as "EAP/PEAP" and *Microsoft Challenge Handshake Authentication Protocol Version 2* (MSCHAP V2), which provides authentication for point-to-point (PPP) connections between a Windows-based computer and network devices such as access points.

So, if you configure the network (access point) to use security mode and choose the Built-in Authentication server, you must configure client stations to use WPA/WPA2 Enterprise (RADIUS) and EAP/PEAP.

If you configure the network (access point) to use this security mode with an external RADIUS server, you must configure the client stations to use WPA/WPA2 Enterprise (RADIUS) and whichever security protocol your RADIUS server is configured to use.

WPA/WPA2 Enterprise (RADIUS) Client Using EAP/PEAP

The Built-In Authentication Server on the AT-TQ2403 Wireless Access Point uses Protected *Extensible Authentication Protocol* (EAP) known as "EAP/PEAP".

- If you are using the Built-in Authentication server with "WPA/WPA2 Enterprise (RADIUS)" security mode on the AT-TQ2403 Wireless Access Point, then you will need to set up wireless clients to use PEAP.

- Additionally, you may have an external RADIUS server that uses EAP/PEAP. If so, you will need to (1) add the AT-TQ2403 Wireless Access Point to the list of RADIUS server clients, and (2) configure your "WPA/WPA2 Enterprise (RADIUS)" wireless clients to use PEAP.

Note: The following example assumes you are using the Built-in Authentication server that comes with the AT-TQ2403 Wireless Access Point. If you are setting up EAP/PEAP on a client of an AP that is using an external RADIUS server, the client configuration process will differ somewhat from this example especially with regard to certificate validation.

If you configured the AT-TQ2403 Wireless Access Point to use WPA/WPA2 Enterprise (RADIUS) security mode and to use either the Built-in Authentication Server or an external RADIUS server that uses EAP/PEAP…

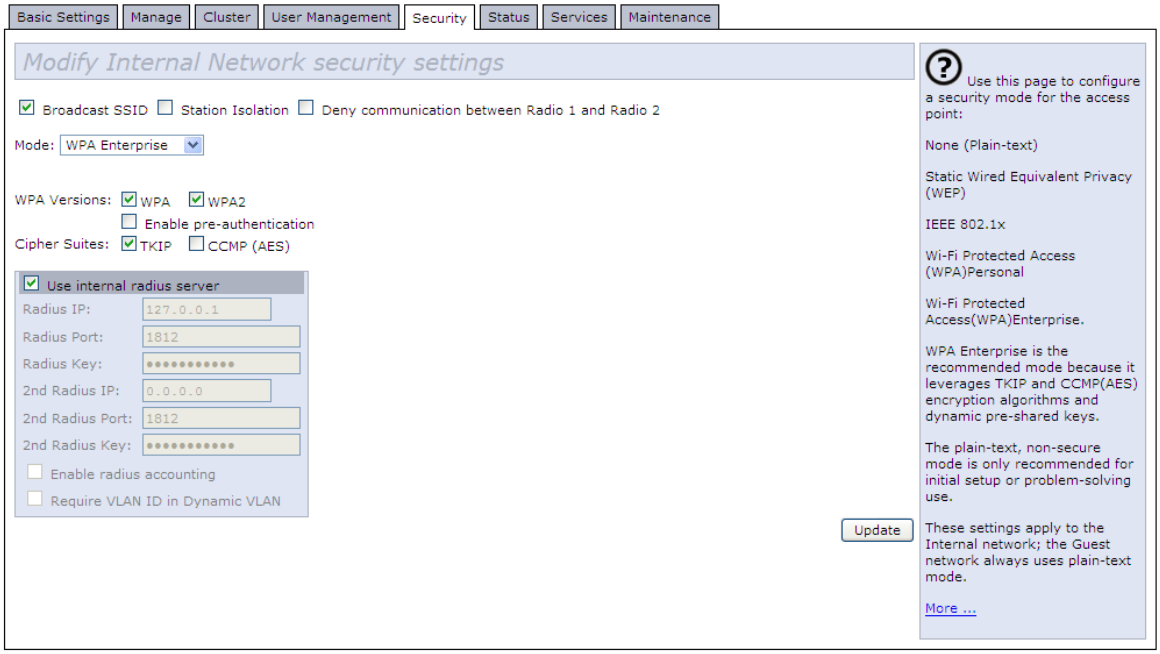


Figure 68: Security Setting Page – WPA Enterprise Setting Page

First set up user accounts on the access point (**User Management** tab)…

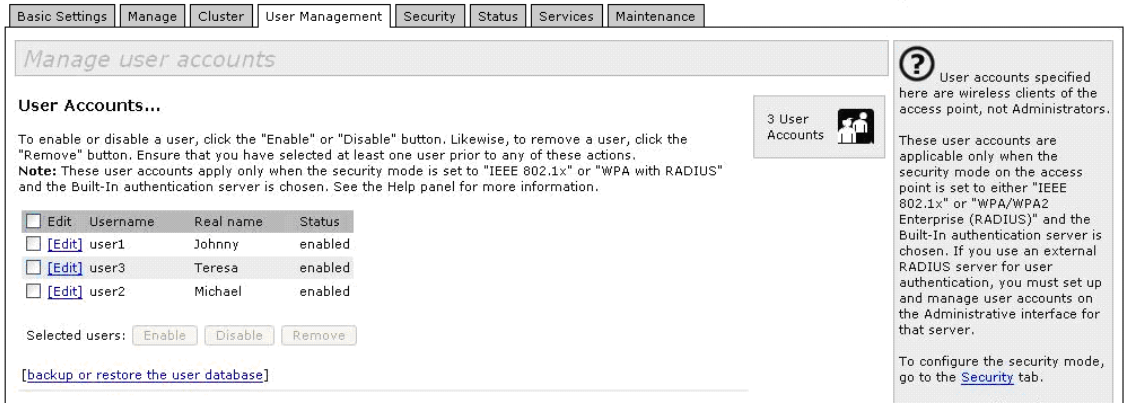


Figure 69: User Management Page

. . . then configure WPA security with PEAP authentication on each client as follows.

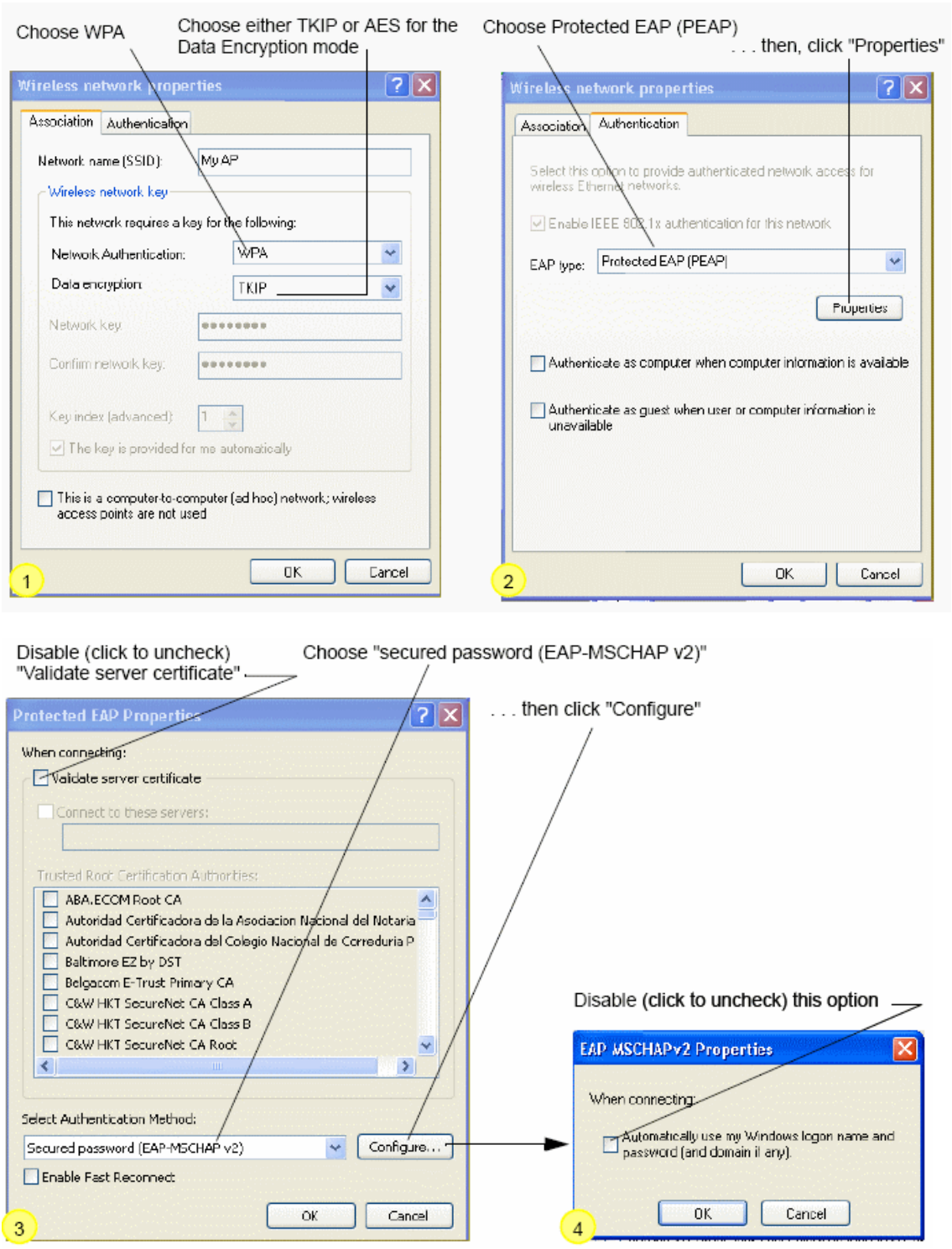


Figure 70: Client Side Security Setting – WPA Enterprise Setting Detail

1. Configure the following settings on the Association and Authentication tabs on the Network Properties dialog.

Association Tab

Field	Setting
Network Authentication	WPA
Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note**: When the Cipher Suite on the access point is set to "Both", then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point.

2. Configure this setting on the Authentication tab.

Authentication Tab

Field	Setting
EAP Type	Choose "Protected EAP (PEAP)"

3. Click **Properties** to bring up the Protected EAP Properties dialog and configure the following settings.

Smart Card or other Certificate Properties Dialog

Field	Setting
Validate Server Certificate	Disable this option (click to uncheck the box). **Note:** This example assumes you are using the Built-in Authentication server on the AP. If you are setting up EAP/PEAP on a client of an AP that is using an external RADIUS server, you might certificate validation and choose a certificate, depending on your infrastructure.
Select Authentication Method	Choose "Secured password (EAP-MSCHAP v2)"

4. Click **Configure** to bring up the EAP MSCHAP v2 Properties dialog.

   On this dialog, disable (click to uncheck) the option to "Automatically use my Windows login name . . ." etc. so that upon login you will be prompted for user name and password.

   Click **OK** on all dialogs (starting with the EAP MSCHAP v2 Properties dialog) to close and save your changes.

Logging on to the Wireless Network with a WPA PEAP Client

"WPA/WPA2 Enterprise (RADIUS)" PEAP clients should now be able to associate with the access point. Client users will be prompted for a user name and password to authenticate with the network.

WPA/WPA2 Enterprise (RADIUS) Client Using EAP-TLS Certificate

Extensible Authentication Protocol (EAP) Transport Layer Security (TLS), or EAP-TLS, is an authentication protocol that supports the use of smart cards and certificates. You have the option of using EAP-TLS with both WPA/WPA2 Enterprise (RADIUS) and IEEE 802.1x modes if you have an external RADIUS server on the network to support it.

Note: If you want to use IEEE 802.1x mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a *Public Key Authority Infrastructure* (PKI), including a *Certificate Authority* (CA), server configured on your network. It is beyond the scope of this document to describe these configurations of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

Some good starting points available on the Web for the Microsoft Windows PKI software are: "How to Install/Uninstall a Public Key Certificate Authority for Windows 2000" at http://support.microsoft.com/default.aspx?scid=kb;EN-US;231881

and How to Configure a Certificate Server at http://support.microsoft.com/default.aspx?scid=kb;en-us;318710#3

To use this type of security, you must do the following:

1. Add the AT-TQ2403 Wireless Access Point to the list of RADIUS server clients. (See "Configuring an External RADIUS Server to Recognize the AT-TQ2403 Wireless Access Point".)

2. Configure the AT-TQ2403 Wireless Access Point to use your RADIUS server (by providing the RADIUS server IP address as part of the "WPA/WPA2 Enterprise [RADIUS]" security mode settings).

3. Configure wireless clients to use WPA security and "Smart Card or other Certificate" as described in this section.

4. Obtain a certificate for this client as described in "Obtaining a TLS-EAP Certificate for a Client".

If you configured the AT-TQ2403 Wireless Access Point to use WPA/WPA2 Enterprise (RADIUS) security mode with an external RADIUS server.

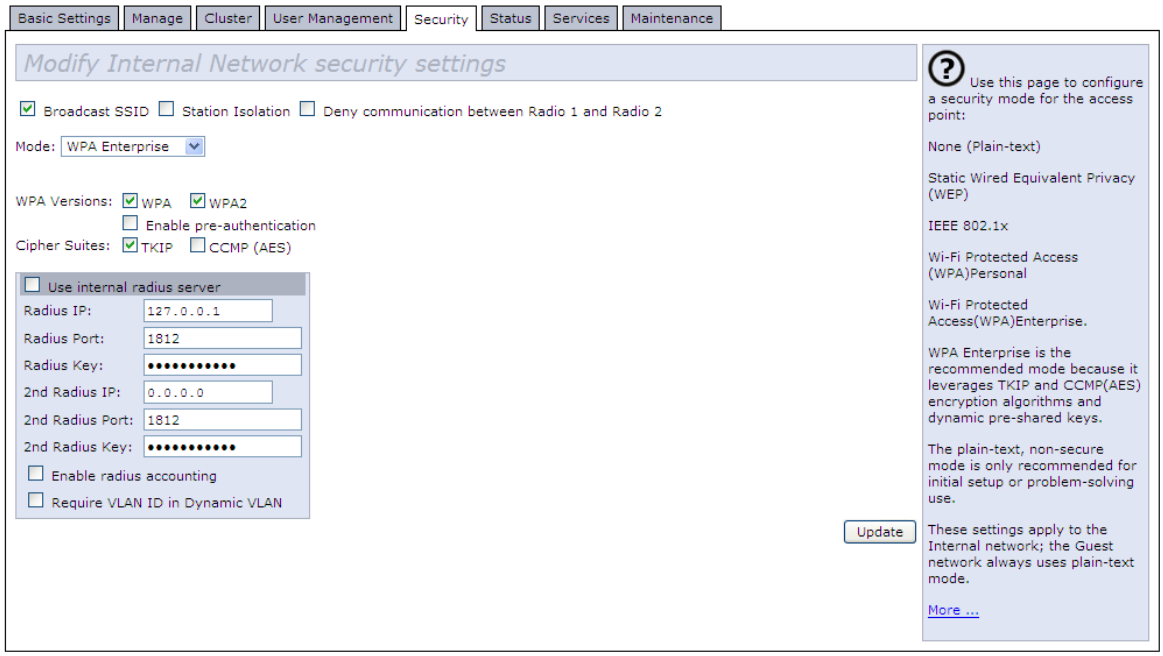


Figure 71: Security Setting Page – WPA Enterprise Setting Page

. . . then configure WPA security with certificate authentication on each client as follows.

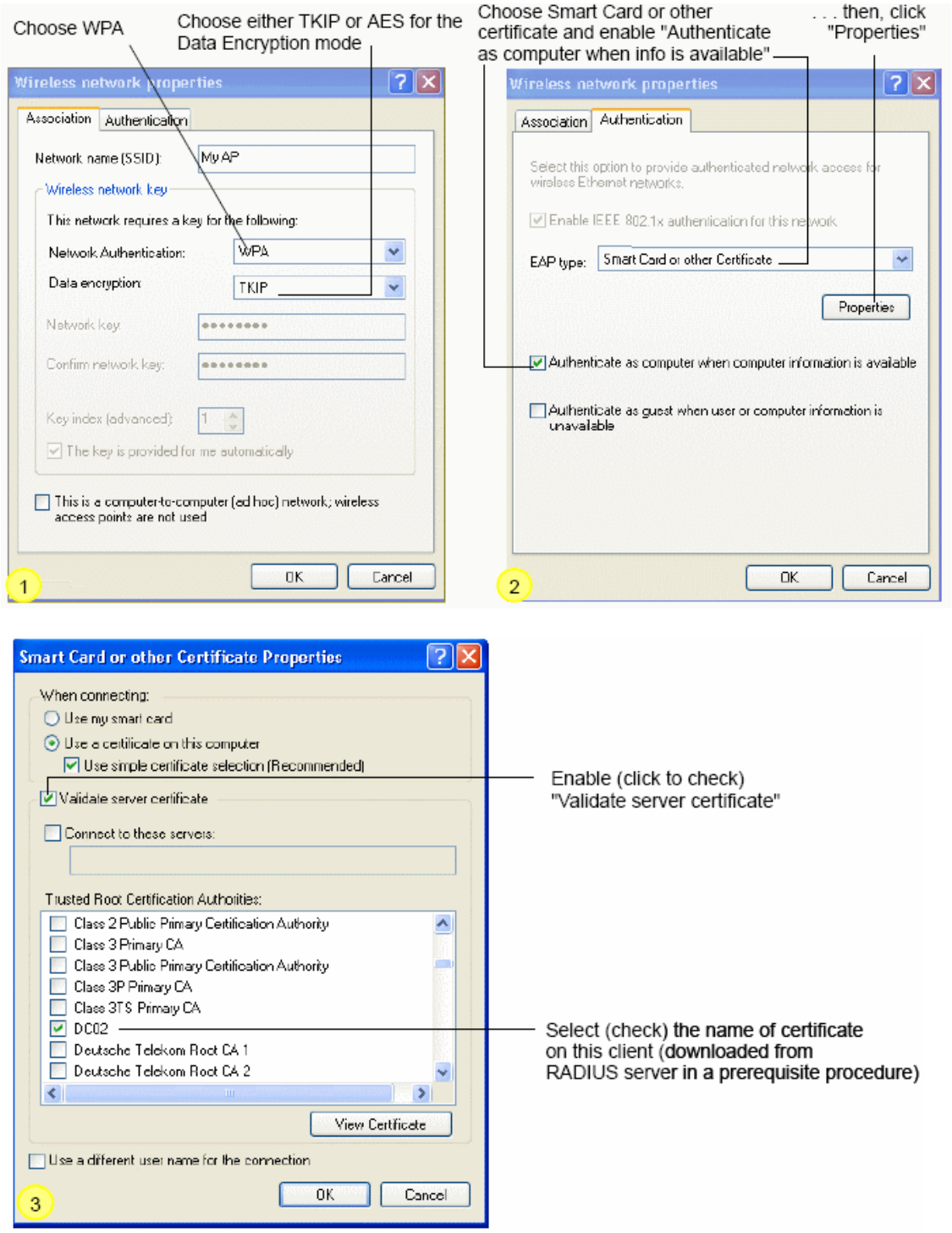


Figure 72: Client Side Security Setting – WPA Setting Detail

1. Configure the following settings on the Association tab on the Network Properties dialog.

Association Tab

Field	Setting
Network Authentication	WPA
Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to "Both", then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point.

2. Configure these settings on the Authentication tab.

Authentication Tab

Field	Setting
Enable IEEE 802.1x authentication for this network	Enable (click to check) this option.
EAP Type	Choose Smart Card or other Certificate

3. Click **Properties** to bring up the Smart Card or other Certificate Properties dialog and enable the "Validate server certificate" option.

Smart Card or other Certificate Properties Dialog

Field	Setting
Validate Server Certificate	Enable this option (click to uncheck the box).
Certificates	In the certificate list shown, select the certificate for this client.

4. To complete the client configuration you must now obtain a certificate from the RADIUS server and install it on this client. For information on how to do this see "Obtaining a TLS-EAP Certificate for a Client".

Logging on to the Wireless Network with a WPA Client Using a Certificate

WPA clients should now be able to connect to the access point using their TLS certificates. The certificate you installed is used when you connect, so you will not be prompted for login information. The certificate is automatically sent to the RADIUS server for authentication and authorization.

WPA/WPA2 Enterprise (RADIUS) Client Using EAP-SIM Certificate

Extensible Authentication Protocol (EAP) Subscriber Identity Module (SIM), or EAP-SIM, is an authentication protocol that supports the use of smart cards and certificates. You have the option of using EAP-SIM with both WPA/WPA2 Enterprise (RADIUS) and IEEE 802.1x modes if you have an external RADIUS server on the network to support it.

To use this type of security, you must do the following:

1. Add the AT-TQ2403 Wireless Access Point to the list of RADIUS server clients. (There are some kind of Radius server support EAP-SIM, such as : FreeRadius)

2. Configure the AT-TQ2403 Wireless Access Point to use your RADIUS server (by providing the RADIUS server IP address as part of the "WPA/WPA2 Enterprise [RADIUS]" security mode settings).

3. Configure wireless clients to use WPA security and "EAP-SIM" as described in this section.

4. Connect USB card reader with SIM card to the wireless client PC.

If you configured the AT-TQ2403 Wireless Access Point to use WPA/WPA2 Enterprise (RADIUS) security mode with an external RADIUS server.

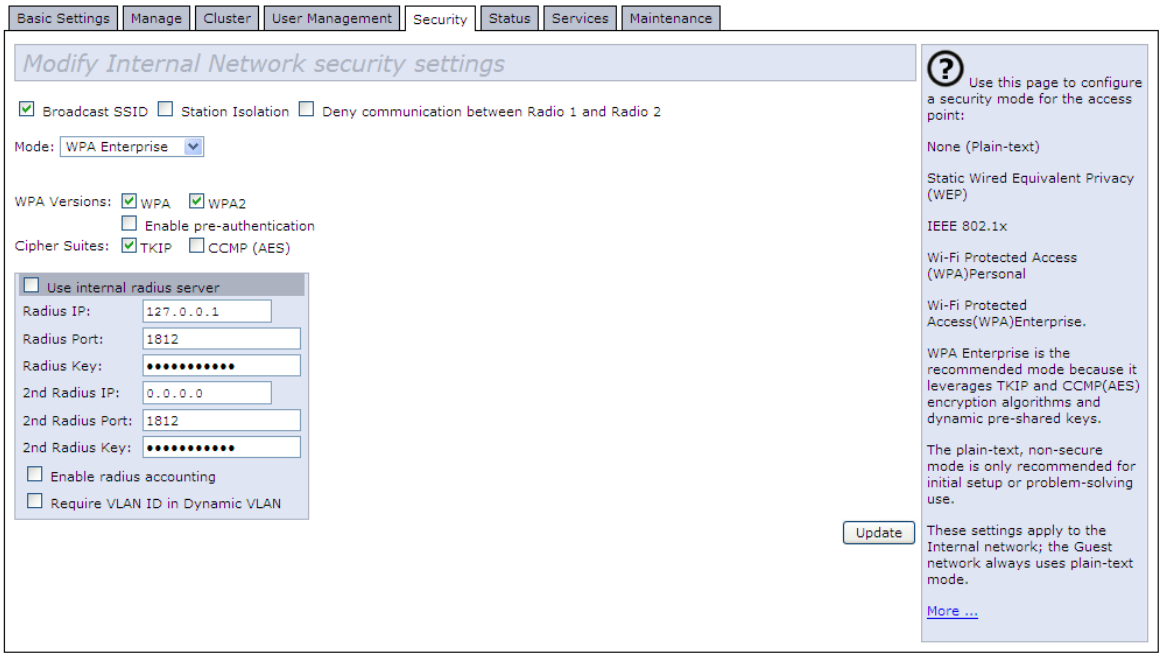


Figure 73: Security Setting Page – WPA Enterprise Setting Page

. . . then configure WPA security with certificate authentication on each client in Intel PROSet as follows.

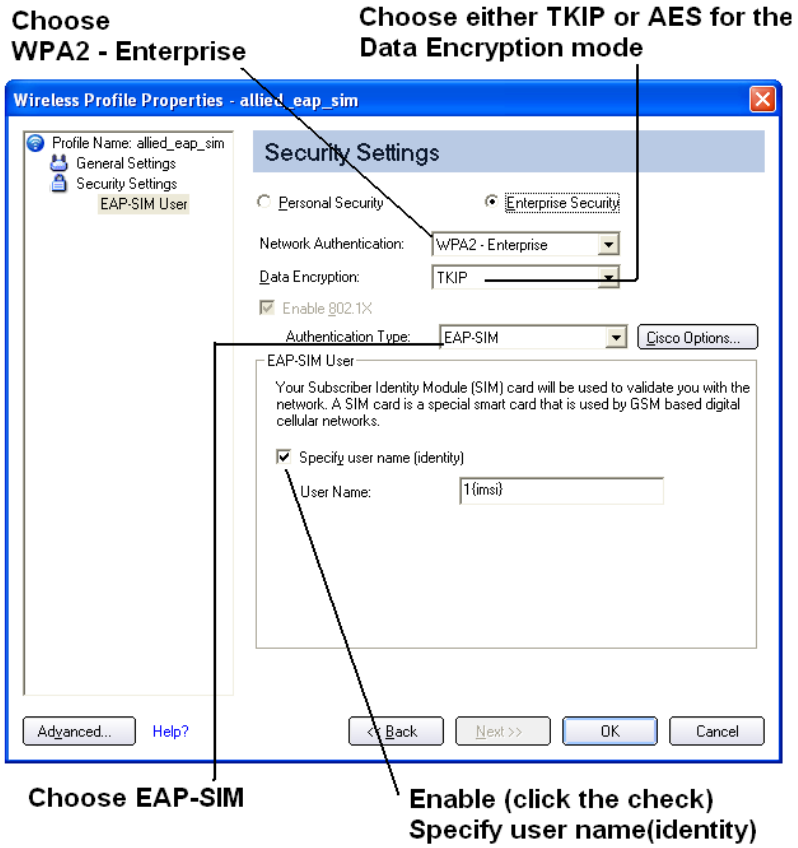


Figure 74: Client Side Security Setting – WPA Setting Detail

Configure the following settings on the "Security Settings" of the Intel PROSet dialog.

Field	Setting
Network Authentication	WPA2 – Enterprise
Data Encryption	TKIP or AES–CCMP depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to "Both", then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point
Authentication Type	Choose EAP-SIM
Specify user name(identity)	Enable (click to check) this option.

After these option Setting, Click **OK**

Logging on to the Wireless Network with a WPA Client Using SIM card

WPA clients should now be able to connect to the access point using their SIM card. The SIM card you insert is used when you connect, so you will not be prompted for login information. The SIM card Information is automatically sent to the RADIUS server for authentication and authorization.

Configuring WPA/WPA2 Personal (PSK) Security on a Client

Wi-Fi Protected Access (WPA) with Pre-Shared Key (PSK) is a Wi-Fi Alliance subset of IEEE 802.11i, which includes Temporal Key Integrity Protocol (TKIP), Advanced Encryption Algorithm (AES), and Counter mode/CBC-MAC Protocol (CCMP) mechanisms. PSK employs a pre-shared key for an initial check of client credentials.

If you configured the AT-TQ2403 Wireless Access Point to use WPA/WPA2 Personal (PSK) security mode.

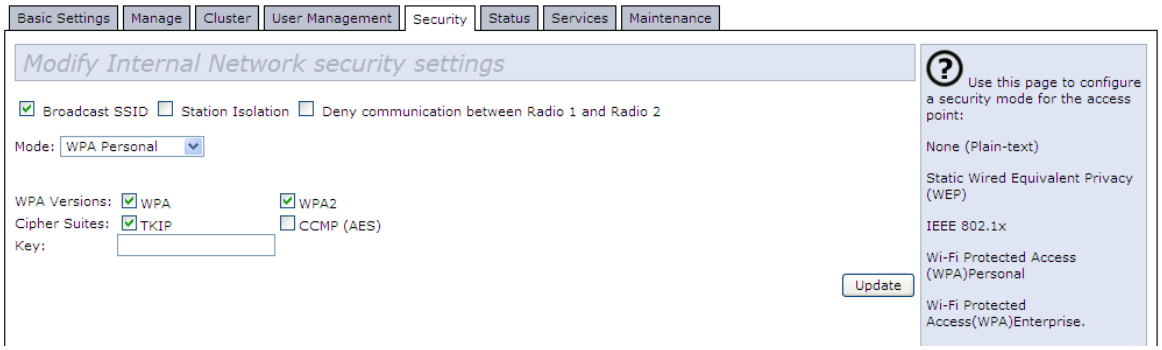


Figure 75: Security Setting Page – WPA Personal Setting Page

. . . then configure WPA/WPA2 Personal (PSK) security on each client as follows.

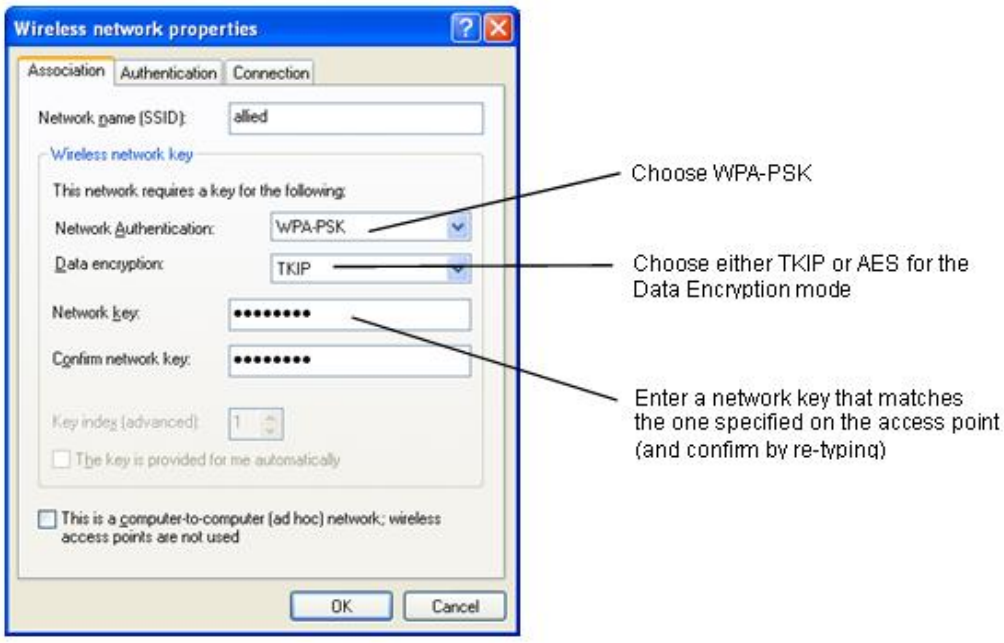


Figure 76: Client Side Security Setting – WPA Personal Setting Detail

Association Tab

Field	Setting
Network Authentication	WPA – PSK
Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to "Both", then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point
Network Key	Provide the key you entered on the access point Security settings for the cipher suite you are using. For example, if the key on the access point is set to use a TKIP key of "012345678", then a TKIP client specify this same string as the network key.
The key is provided for me automatically	This box should be disabled automatically based on other settings.

Authentication Tab

Field	Setting
Enable IEEE 802.1x authentication for this network	Make sure that IEEE 802.1x authentication is disabled (unchecked). (Setting the encryption mode to WEP should automatically disable authentication.)

Click **OK** on the Wireless Network Properties dialog to close it and save your changes.

Connecting to the Wireless Network with a WPA-PSK Client

WPA-PSK clients should now be able to associate and authenticate with the access point. As a client, you will not be prompted for a key. The TKIP or AES key you configured on the client security settings is automatically used when you connect.

Configuring an External RADIUS Server to Recognize the AT-TQ2403 Wireless Access Point

An external *Remote Authentication Dial-in User Server* (RADIUS) server running on the network can support of EAP-TLS smart card/certificate distribution to clients in a *Public Key Infrastructure* (PKI) as well as EAP-PEAP user account setup and authentication. By *external* RADIUS server, we mean an authentication server external to the access point itself. This is to distinguish between the scenario in which you use a network RADIUS server versus one in which you use the *Built-in Authentication Server* on the AT-TQ2403 Wireless Access Point.

This section provides an example of configuring an external RADIUS server for the purposes of authenticating and authorizing TLS-EAP certificates from wireless clients of a particular AT-TQ2403 Wireless Access Point configured for either "WPA/WPA2 Enterprise (RADIUS)" or "IEEE 802.1x" security modes. The intention of this section is to provide some idea of what this process will look like;

procedures will vary depending on the RADIUS server you use and how you configure it. For this example, we use the Internet Authentication Service that comes with Microsoft Windows 2003 server.

Note: This document does not describe how to set up Administrative users on the RADIUS server. In this example, we assume you already have RADIUS server user accounts configured. You will need a RADIUS server user name and password for both this procedure and the following one that describes how to obtain and install a certificate on the wireless client. Please consult the documentation for your RADIUS server for information on setting up user accounts.

The purpose of this procedure is to identify your AT-TQ2403 Wireless Access Point as a "client" to the RADIUS server. The RADIUS server can then handle authentication and authorization of wireless clients for the AP. This procedure is required *per access point*. If you have more than one access point with which you plan to use an external RADIUS server, you need to follow these steps for each of those APs.

Keep in mind that the information you need to provide to the RADIUS server about the access point corresponds to settings on the access point (Security) and vice versa. You should have already provided the RADIUS server IP Address to the AP; in the steps that follow you will provide the access point IP address to the RADIUS server. The RADIUS Key provided on the AP is the "shared secret" you will provide to the RADIUS server.

Note: The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides. On the current release of the AT-TQ2403 Wireless Access Point, the RADIUS server *User Datagram Protocol* (UDP) ports used by the access point are not configurable. (The AT-TQ2403 Wireless Access Point is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.)

---

1. Log on to the system hosting your RADIUS server and bring up the Internet Authentication Service.

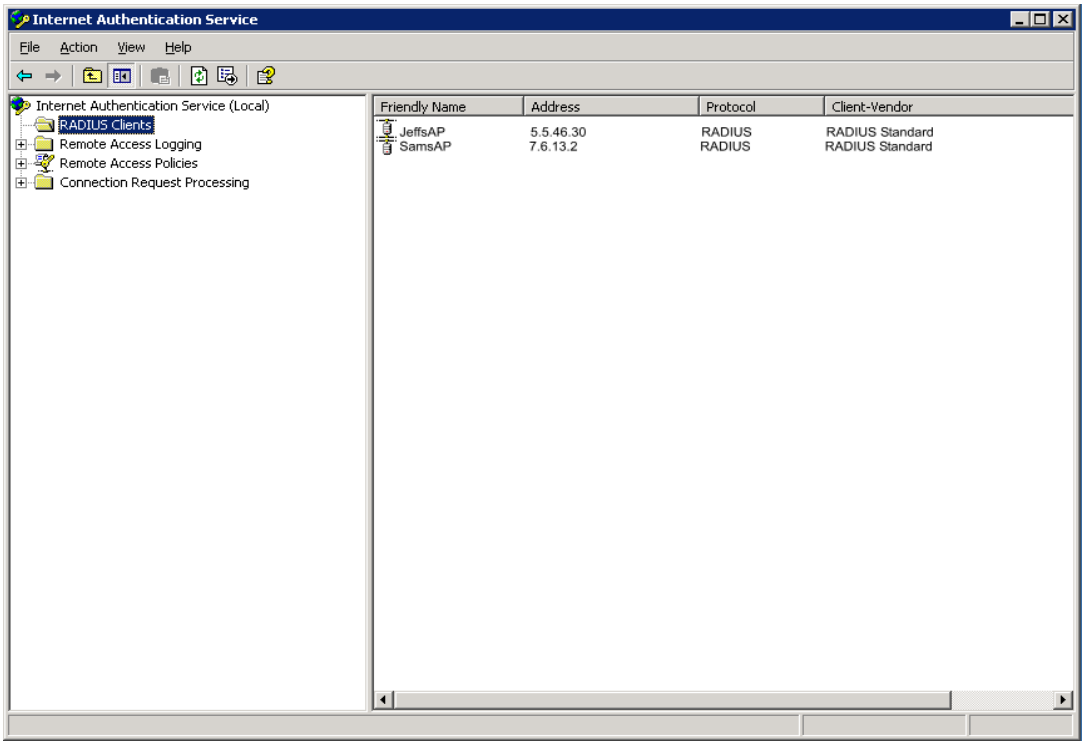


Figure 77: Radius Server – Internet Authentication Service

2. In the left panel, right click on "**RADIUS Clients**" node and choose **New > Radius Client** from the popup menu.

3. On the first screen of the New RADIUS Client wizard provide information about the AT-TQ2403 Wireless Access Point to which you want your clients to connect:

   ☞ A logical (friendly) name for the access point. (You might want to use DNS name or location.)

   ☞ IP address for the access point.

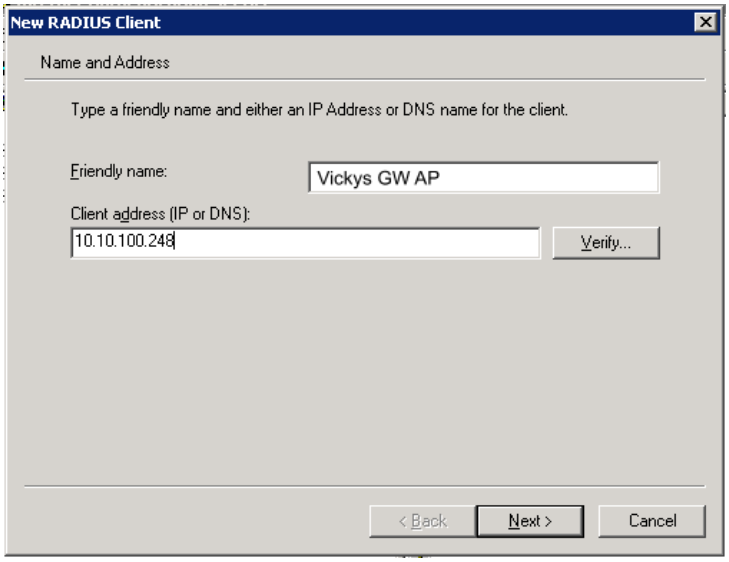


Figure 78: Radius Server Setting – Input New Radius Client

Click **Next**.

4. For the "Shared secret" enter the RADIUS Key you provided to the access point (on the Security page). Re-type the key to confirm.

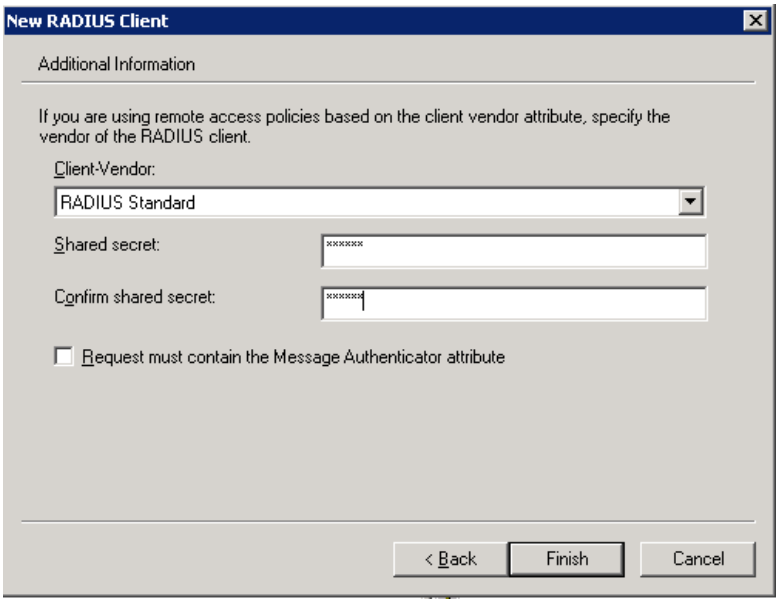


Figure 79: Radius Server Setting – New Radius Client Setting

5. Click **Finish**

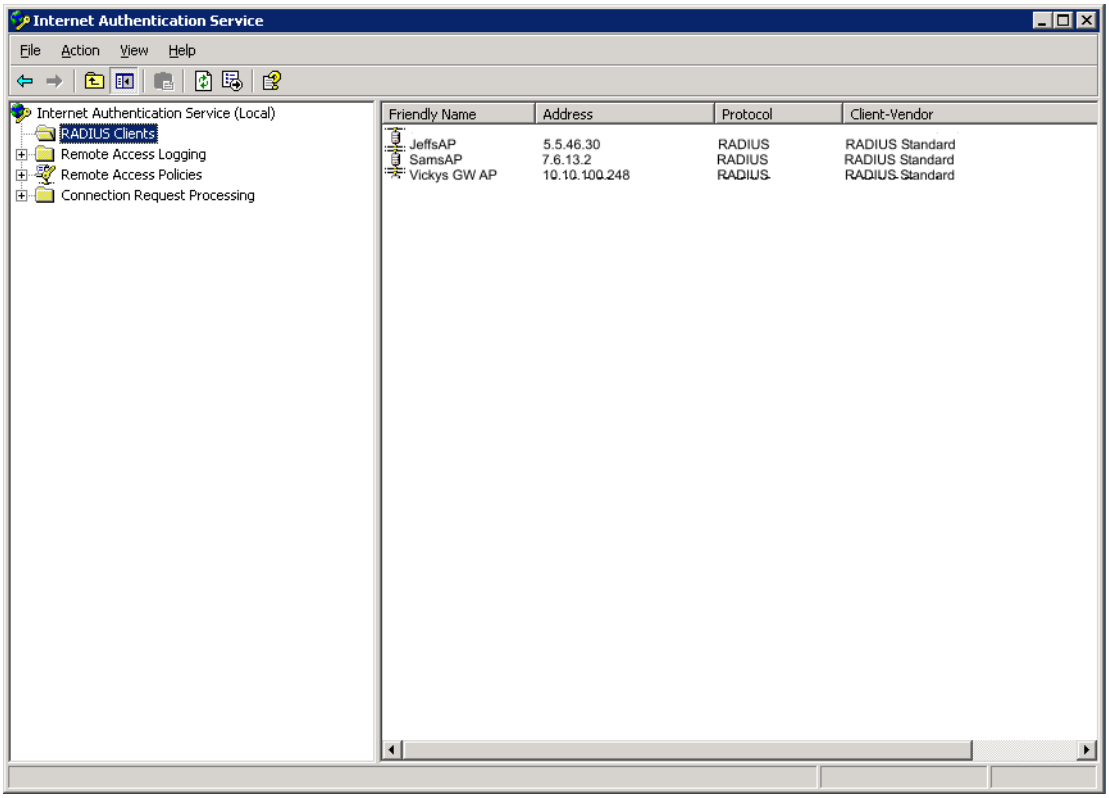


Figure 80: Radius Server

The access point is now displayed as a client of the Authentication Server.

Obtaining a TLS-EAP Certificate for a Client

Note: If you want to use IEEE 802.1x mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a *Public Key Authority Infrastructure* (PKI), including a *Certificate Authority* (CA), server configured on your network. It is beyond the scope of this document to describe these configuration of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

Some good starting points available on the Web for the Microsoft Windows PKI software are: "How to Install/Uninstall a Public Key Certificate Authority for Windows 2000" at http://support.microsoft.com/default.aspx?scid=kb;EN-US;231881

and How to Configure a Certificate Server at http://support.microsoft.com/default.aspx?scid=kb;en-us;318710#3

Wireless clients configured to use either "WPA/WPA2 Enterprise (RADIUS)" or" IEEE 802.1x" security modes with an external RADIUS server that supports TLS-EAP certificates must obtain a TLS certificate from the RADIUS server.

This is an initial one-time step that must be completed on each client that uses either of these modes with certificates. In this procedure, we use the Microsoft Certificate Server as an example.

To obtain a certificate for a client, follow these steps.

1. Go to the following URL in a Web browser:

   https://*IPAddressOfServer*/certsrv/

   Where IPAddressOfServer is the IP address of your external RADIUS server, or of the *Certificate Authority* (CA), depending on the configuration of your infrastructure.

2. Click **Yes** to proceed to the secure Web page for the server.

Figure 81: Web Security Alert

The Welcome screen for the Certificate Server is displayed in the browser.

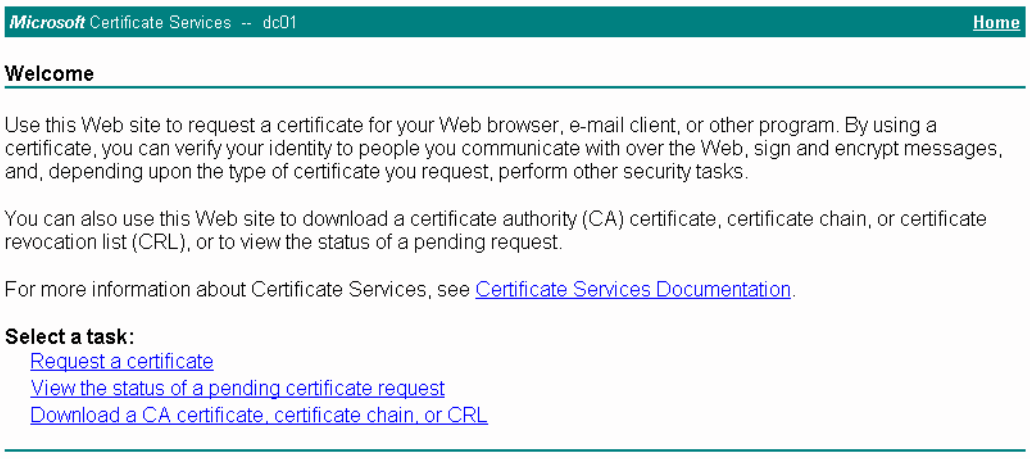


Figure 82: Welcome Message from Certification Server

3. Click **Request a certificate** to get the login prompt for the RADIUS server.

4. Provide a valid user name and password to access the RADIUS server.

Figure 83: Radius Server Log-in Page

Note: The user name and password you need to provide here is for access to the RADIUS server, for which you will already have user accounts configured at this point. This document does not describe how to set up Administrative user accounts on the RADIUS server. Please consult the documentation for your RADIUS server for these procedures.

5. Click **User Certificate** on the next page displayed.

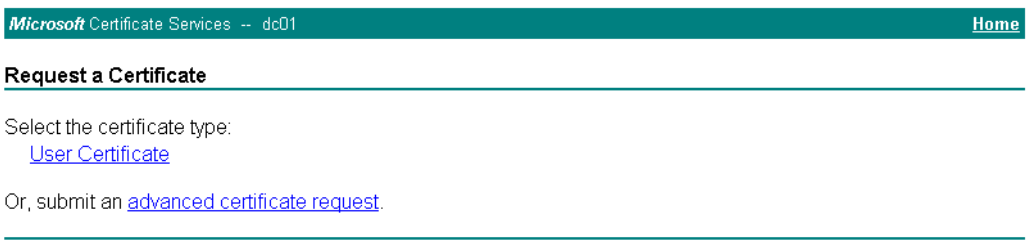


Figure 84: User Certification Installation – Request a Certification

6. Click **Yes** on the dialog displayed to install the certificate.

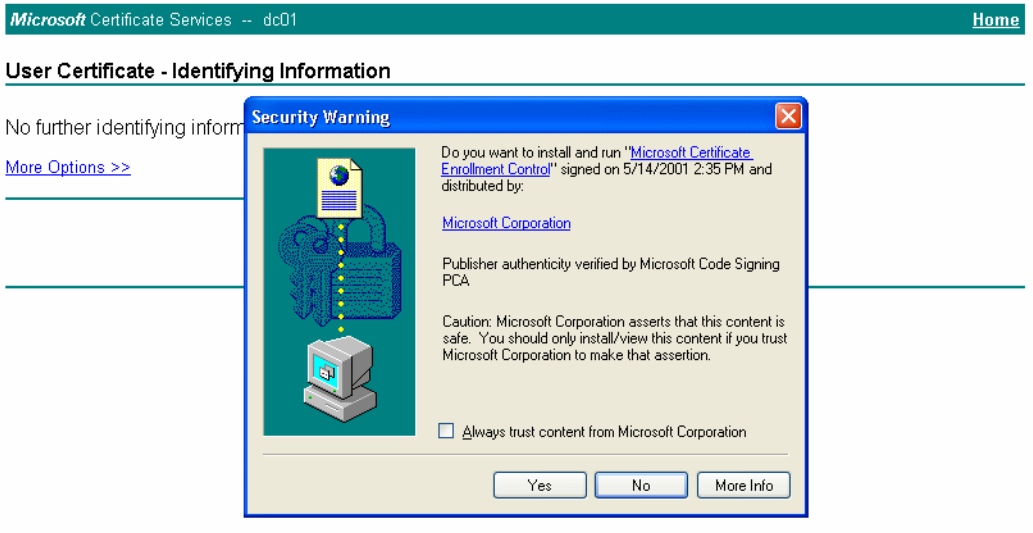


Figure 85: User Certification Installation – Identifying Information

7. Click **Submit** to complete and click **Yes** to confirm the submittal on the popup dialog.

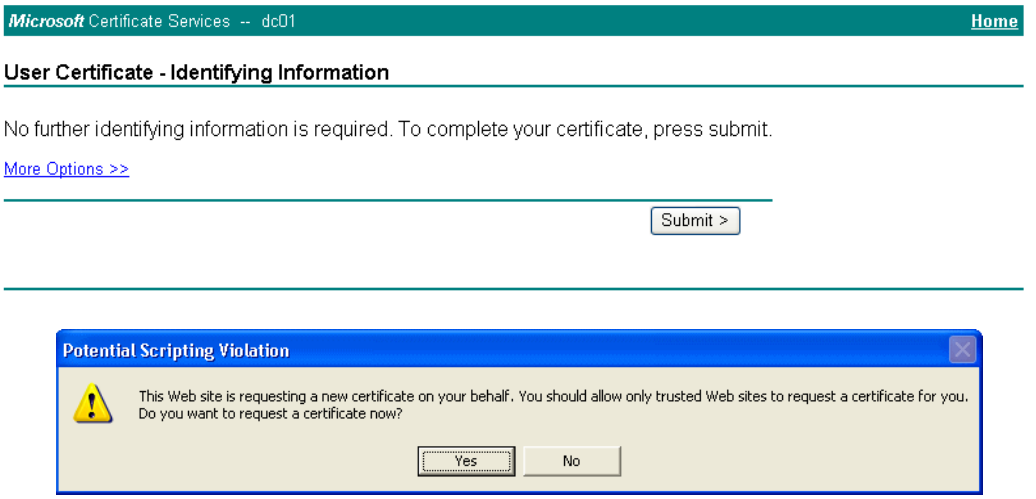


Figure 86: User Certification Installation – Submit

8. Click **Install this certificate** to install the newly issued certificate on your client station. (Also, click **Yes** on the popup windows to confirm the install and to add the certificate to the Root Store.)

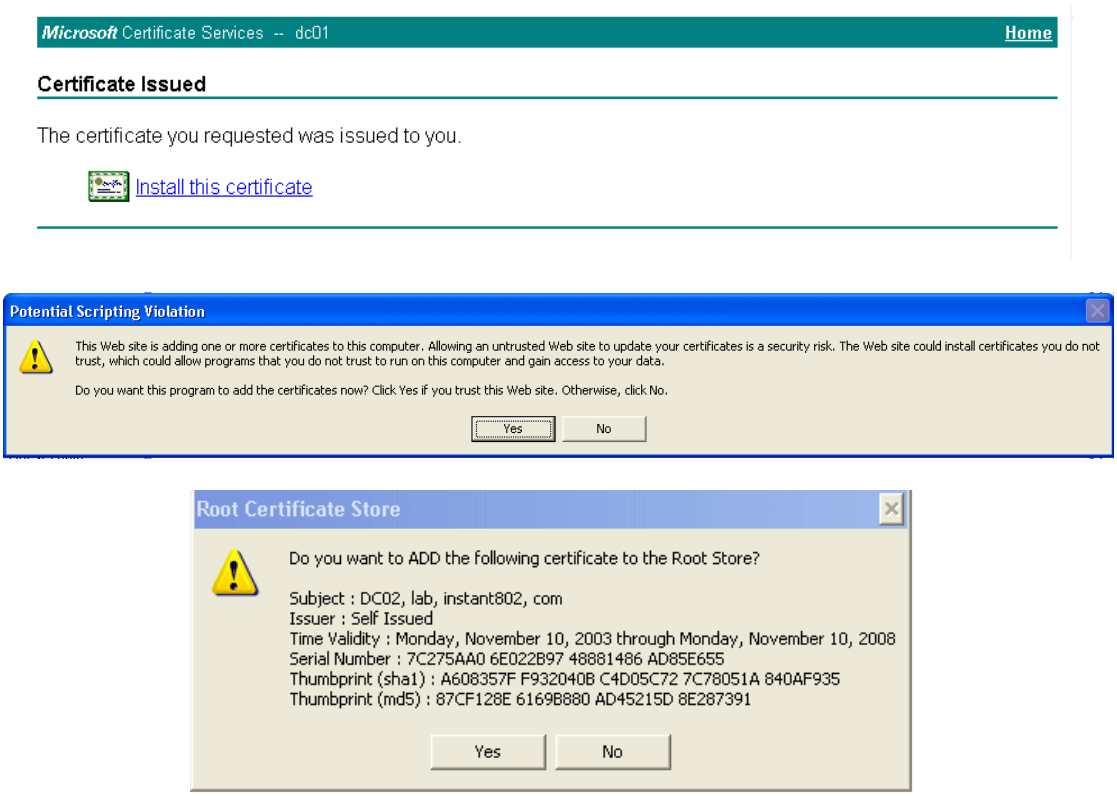


Figure 87: User Certification Installation – Certification Issued

A success message is displayed indicating the certificate is now installed on the client.

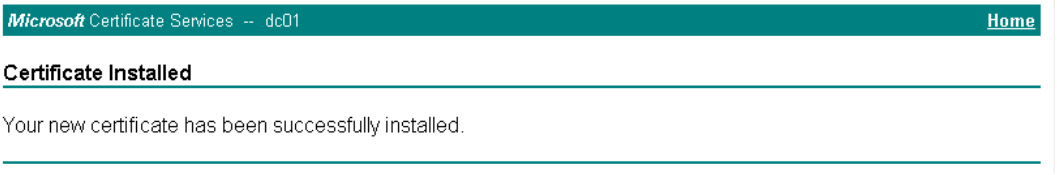


Figure 88: User Certification Installation – Certification Installed

Configuring RADIUS Server for VLAN tags

A VLAN is a grouping of ports on a switch or a grouping of ports on different switches. Dynamic VLANs allow you to assign a user to a VLAN, and switches dynamically use this information to configure the port on the switch automatically. Selection of the VLAN is usually based on the identity of the user. The RADIUS server informs the NAS (for example the access point) of the selected VLAN as part of the authentication. This setup enables users of Dynamic VLANs to move from one location to another without intervention and without having to make any changes to the switches.

In the case of AT-TQ2403 Wireless Access Point, if the user has selected to use an external RADIUS server (configured on the Security page) then an External RADIUS server will try to authenticate the user. A user's authentication credentials are passed to a RADIUS server. If these credentials are found to be valid, the NAS configures the port to the VLAN indicated by the RADIUS authentication server.

Configuring a RADIUS server

A RADIUS server needs to be configured to use Tunnel attributes in Access-Accept messages, in order to inform the access point about the selected VLAN. These attributes are defined in RFC 2868 and their use for dynamic VLAN is specified in RFC 3580.

In the case of FreeRADIUS server, the following options may be set in the users file to add the necessary attributes.

example-userAuth-Type :=EAP, User-Password =="password"

Tunnel-Tyep = 13,

Tunnel-Medium-Type = 6,

Tunnel-Private-Group-ID = 7

Tunnel-Type and Tunnel-Medium-Type use the same values for all stations. Tunnel-Private-Group-ID is the selected VLAN ID, however it can be different for each user.

Appendix B: Troubleshooting

This section provides information about how to solve common problems you might encounter in the course of updating network configurations on networks served by multiple, clustered access points.

- Wireless Distribution System (WDS) Problems and Solutions
- Cluster Recovery
- BootLoader Recovery

Wireless Distribution System (WDS) Problems and Solutions

If you are having trouble configuring a WDS link, be sure you have read the notes and cautions in "Configuring WDS Settings". These notes are reprinted here for your convenience. The most common problem Administrators encounter with WDS setups is forgetting to set both access points in the link to the same radio channel and IEEE 802.11 mode. That prerequisite, as well as others, is listed in the notes below.

Note: When using WDS, be sure to configure WDS settings on *both* access points participating in the WDS link.

- You can have only one WDS link between any pair of access points. That is, a remote MAC address may appear only once on the WDS page for a particular access point.
- Both access points participating in a WDS link must be on the same Radio channel and using the same IEEE 802.11 mode. (See "Configuring Radio Settings" for information on configuring the Radio mode and channel.) For more information on IEEE 802.11h, see "802.11h Regulatory Domain Control".

Any two access points can be connected by only a single path; either a WDS bridge (wireless) or an Ethernet connection (wired), but not both.

Do not create "backup" links.

If you can trace more than one path between any pair of APs going through any combination of Ethernet or WDS links, you have a loop.

You can only extend or bridge either the Internal or Guest network but not both.

Cluster Recovery

In cases where the access points in a cluster become out of sync or an access point cannot join or be removed from a cluster, the following methods for cluster recovery are recommended.

Reboot or Reset Access Point

These recovery methods are given in the order you should try them. In all but the last case (stop clustering), you only need to reset or reboot the particular access point whose configuration is out of sync with other cluster members or cannot remove/join cluster.

- Physically reboot the access point by pressing the **Power** button on the device.

- Reset the access point from its Administration UI. To do this, go to **http://IPAddressOfAccessPoint**, navigate to **Reset Configuration**, and click the **Reset** button. (IP addresses for APs are on the **Cluster > Access Points** page for any cluster member.)

- Physically reset the access point by pressing the **Reset** button on the device.

BootLoader Recovery

If you power off the AP during the firmware upgrading process, the AP may no longer boot.

To start bootloader firmware recovery, perform the following steps:

Step 1 : Download the newest firmware and rename the file as "TQ2403_upgrade.img"

Step 2 : Power off the AP

Step 3 : Connect the PC with the AP via Ethernet port.

Step 4 : Set the IP of the PC to 192.168.1.1. Make sure there is no device configured with IP address equal to 192.168.1.230 in the network.

Step 5 : Run TFTP server on the PC and save the file "TQ2403_upgrade.img" to TFTP server directory.

Step 6 : Power on the AP.

The firmware recovery process will start. Please wait about 5 minutes and the AP will boot up again.

Appendix C: Command Line Interface (CLI) for AP Configuration

In addition to the Web based user interface, the AT-TQ2403 Management Software includes a command line interface (CLI) for administering the access point. The CLI lets you view and modify status and configuration information.

From the client station perspective, even a single deployed AT-TQ2403 Management Software broadcasting its "network name" to clients constitutes a wireless network. Keep in mind that CLI configuration commands, like Web UI settings, can affect a single access point running in stand-alone mode or automatically propagate to a network of clustered access points that share the same settings. (For more information on clustering, see "Managing Access Points and Clusters".

The following topics provide an introduction to the class structure upon which the CLI is based, CLI commands, and examples of using the CLI to get or set configuration information on an access point or cluster of APs:

- Comparison of Settings Configurable with the CLI and Web UI
- How to Access the CLI for an Access Point
- Quick View of Commands and How to Get Help
- Command Usage and Configuration Examples
    - Access Point and Cluster Settings
    - Ethernet (Wired) Interface
    - Wireless Interface
    - Configuring Virtual Wireless Networks (VWNs)
    - Security
    - Radio Settings
    - MAC Filtering
    - Load Balancing
    - Quality of Service
    - Wireless Distribution System (WDS)
    - Simple Network Management Protocol (SNMP)
    - Time Protocol
    - Pre-Config Rogue AP
    - Reboot the AP
    - Reset the AP to Factory Defaults

- Upgrade the Firmware

- Keyboard Shortcuts and Tab Completion Help

- CLI Classes and Properties Reference

Comparison of Settings Configurable with the CLI and Web UI

The command line interface (CLI) and the Web user interface (UI) to the AT-TQ2403 Management Software are designed to suit the preferences and requirements for different types of users or scenarios. Most administrators will probably use both UIs in different contexts. Some features (such as Clustering) can only be configured from the Web UI and, conversely, some details and more complex configurations are only available through the CLI.

The CLI is particularly useful in that it provides an interface to which you can write programmatic scripts for AP configurations. Finally, the CLI may be less resource-intensive than a Web interface.

Note: When you write programmatic scripts for AP configurations, suggest adding delay time for 3 seconds between every command.

For example:

1. sendln "set interface wlan0 ssid r1vlan1"
2. wait "AT-TQ2403#"
3. pause 3
4. sendln "set interface wlan1 ssid r2vlan1"
5. wait "AT-TQ2403#"
6. pause 3

The following table shows a feature-by-feature comparison of which settings can be configured through the CLI or the Web UI, and which are configurable with either.

Feature or Setting	Configurable from CLI	Configurable from Web UI
Basic Settings • Getting/changing Administrator Password • Getting/changing AP name and location • Viewing information like MAC, IP address, and Firmware version	Yes	Yes
Access Point and Cluster Settings	Get existing settings only. You cannot set configuration *policy* or other cluster features from the CLI. Use the Web UI to change clustering settings.	Yes

Feature or Setting	Configurable from CLI	Configurable from Web UI
User Accounts	Yes	Yes
User Database Backup and Restore	You cannot backup or restore a user database from the CLI. Please use the Web UI to do this as described in Backing Up and Restoring a User Database.	Yes
Sessions	The CLI does not provide session monitoring information. Use the Web UI to view client sessions.	Yes
Channel Management	You cannot configure Channel Management from the CLI. Please use the Web UI for this as described in Channel Management	Yes
Wireless Neighborhood	You cannot view the cluster-based **Wireless Neighborhood** from the CLI. Please use the Web UI for this as described in Wireless Neighborhood.	Yes
Status	Yes	Yes
Ethernet (Wired) Interface	Yes	Yes
Wireless Interface	Yes	Yes
Security	Yes	Yes
Guest Access	Yes	Yes
Enable/Configure Guest Login Welcome Page	Yes	Yes
Configuring Virtual Wireless Networks (VWNs)	Yes	Yes
Radio Settings	Yes	Yes
MAC Filtering	Yes	Yes
Load Balancing	Yes	Yes
Quality of Service	Yes	Yes
Wireless Distribution System (WDS)	yes	yes

Feature or Setting	Configurable from CLI	Configurable from Web UI
Time Protocol	Yes	Yes
Reboot the AP	Yes	Yes
Reset the AP to Factory Defaults	Yes	Yes
Upgrade the Firmware	Yes	Yes

How to Access the CLI for an Access Point

You can use any of these methods to access the command line interface (CLI) for the access point or wireless network:

- Telnet Connection to the AP
- SSH Connection to the AP

Telnet Connection to the AP

If you know already have your network deployed and know the IP address of your access point, you can use a remote "Telnet" connection to the access point to view the system console over the network.

Note: The default Static IP address is **192.168.1.230**. If there is no DHCP server on the network, the AP retains this static IP address at first-time startup. (For more about IP addressing, see "Understanding Dynamic and Static IP Addressing on the AT-TQ2403 Management Software".)

The disadvantage of using Telnet is that with Telnet you cannot access the system console until the AP is fully initialized. Therefore, you cannot view AP startup messages. However, once the AP is operational you can use a Telnet connection to view the AP system console and enter CLI commands.

1. Bring up a command window on your PC.

   (For example, from the system tray on the desktop choose **Start > Run** to bring up the Run dialog, and type cmd in the Open property, and click **OK**.)

2. At the command prompt, type the following:

   telnet *IPAddressOfAccessPoint*

   where IPAddressOfAccessPoint is the address of the access point you want to monitor.

   (If your Domain Name Server is configured to map domain names to IP addresses via DHCP, you can also telnet to the domain name of the AP.)

3. You will be prompted for an Administrator user name and password for the access point.

   AT-TQ2403 login:
   Password:

   Enter the default Administrator username and password for the AT-TQ2403 Management

Software (manager, friend), and press "**Enter**" after each. (The password is masked, so it will not be displayed on the screen.)

When the user name and password is accepted, the screen displays the AT-TQ2403 Management Software help command prompt.

AT-TQ2403 login: *manager*
Password: *friend*
Enter 'help' for help.

You are now ready to enter CLI commands at the command line prompt.

SSH Connection to the AP

If you know already have your network deployed and know the IP address of your access point, you can use a remote "SSH" connection to the access point to view the system console over the network.

Note: The default Static IP address is **192.168.1.230**. If there is no DHCP server on the network, the AP retains this static IP address at first-time startup. (For more about IP addressing, see "Understanding Dynamic and Static IP Addressing on the AT-TQ2403 Management Software".)

Using a SSH connection to the access point is similar to "Telnet" in that it gives you remote access to the system console and CLI. SSH has the added advantage of being a secure connection traffic encrypted.

To use a SSH connection, you need to have SSH software installed on your PC (such as PuTTY, which is available at **http://www.chiark.greenend.org.uk/~sgtatham/putty/**)

1. Start your SSH application. (We use PuTTY as an example.)

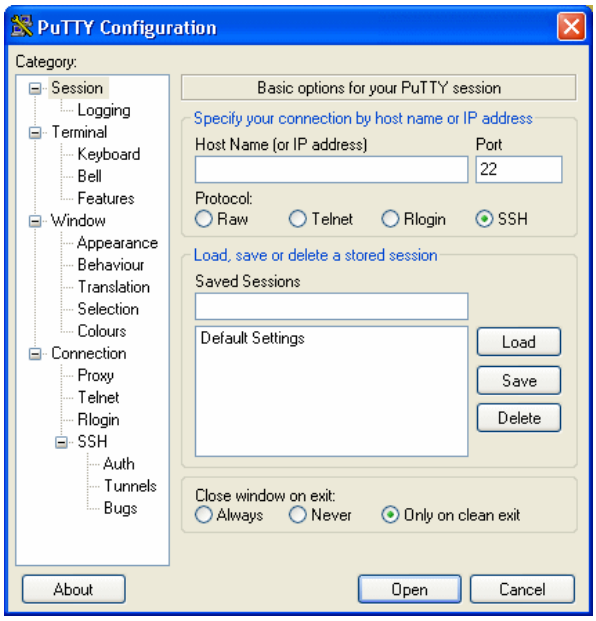


Figure 89: SSH Application Setting – PuTTY as an Eample

2. Enter the IP address of access point and click **Open**.

   (If your Domain Name Server is configured to map domain names to IP addresses via DHCP, you can enter the domain name of the AP instead of an IP address.)

This brings up the SSH command window and establishes a connection to the access point. The login prompt is displayed.

```
login as:
```

3. Enter the default Administrator username and password for the AT-TQ2403 Management Software (manager, friend), and press "**Enter**" after each. (The password is masked, so it will not be displayed on the screen.)

```
login as: manager
admin@192.168.1.230's password:
Enter 'help' for help.
```

When the user name and password is accepted, the screen displays the AT-TQ2403 Management Software help command prompt.

```
AT-TQ2403#
```

You are now ready to enter CLI commands at the command line prompt.

Quick View of Commands and How to Get Help

- Commands and Syntax
- Getting Help on Commands at the CLI
- Ready to Get Started?

Caution:

Settings updated from the CLI (with **get**, **set**, **add**, **remove** commands) will not be saved to the startup configuration unless you explicitly save them via the **save-running** command. For a description of configurations maintained on the AP and details on how to save your updates, see "Saving Configuration Changes"

Commands and Syntax

The CLI for the AT-TQ2403 Management Software provides the following commands for manipulating objects.

Note:

- **named_class** is a class of an object from the configuration whose instances are individually named. Named classes have two types: unique-named and group-named. All the instances of a unique named class must be assigned unique names. In a group named class, instances that have the same name form a group.
- **instance** is a name of an instance of class.
- property values cannot contain spaces unless the value is in quotes

For a detailed class and property reference, see "CLI Classes and Properties Reference".

CLI Command	Description
get	The "get" command allows you to get the property values of existing instances of a class. Classes can be "named" or "unnamed". The command syntax is: get unnamed-class [property ... | detail] get named-class [instance | all [property ... | name | detail]] The rest of the command line is optional. If provided, it is either a list of one or more **properties**, or the keyword detail. An example of using the "get" command on an unnamed class with a single instance is: get log (There is only one log on the AP. This command returns information on the log file.) An example of using the "get" command on an unnamed class with multiple instances is: get log-entry (There are multiple log entries but they are not named. This command returns all log entries.) An example of using the "get" command on a named class with multiple instances is: get bss wlan0bssInternal (There are multiple bss's and they are named. This command returns information on the BSS named "wlan0bssInternal".) An example of using the "get" command on a named class to get all instances: get radius-user all name get radius-user all **Note:** "wlan0bssInternal" is the name of the basic service set (BSS) on the internal network (wlan0 interface). For information on interfaces, see "Understanding Interfaces as Presented in the CLI".

CLI Command	Description
set	The "set" command allows you to set the property values of existing instances of a class. set unnamed-class [with qualifier-property qualifier-value ... to] property value . . . The first argument is an unnamed class in the configuration. After this is an optional qualifier that restricts the set to only some instances. For singleton classes (with only one instance) no qualifier is needed. If there is a qualifier, it starts with the keyword with, then has a sequence of one or more qualifier-property qualifier-value pairs, and ends with the keyword to. If these are included, then only instances whose present value of qualifier- property is qualifier-value will be set. The qualifier-value arguments cannot contain spaces. Therefore, you cannot select instances whose desired qualifier-value has a space in it. The rest of the command line contains property-value pairs. set named-class instance | all [with qualifier-property qualifier-value ... to] property value . . . The first argument is either a named class in the configuration. The next argument is either the name of the instance to set, or the keyword all, which indicates that all instances should be set. Classes with multiple instances can be set consecutively in the same command line as shown in Example 4 below. The qualifier-value arguments cannot contain spaces. Here are some examples, **1.** set interface wlan0 ssid "Vicky's AP" **2.** set radio all beacon-interval 200 **3.** set tx-queue wlan0 with queue data0 to aifs 3 **4.** set tx-queue wlan0 with queue data0 to aifs 7 cwmin 15 cwmax 1024 burst 0 **5.** set bridge-port br0 with interface eth0 to path-cost 200 **Note:** For information on interfaces used in this example (such as wlan0, br0, or eth0) see "Understanding Interfaces as Presented in the CLI".

CLI Command	Description
Add	The "add" command allows you to add a new instance or group of instances of a class. add unique-named-class instance [property value ...] add group-named-class instance [property value ...] add anonymous-class [property value ...] For example: add radius-user wally **Note:** If you're adding an instance to a unique-named class, you must assign the instance a name not already in use by any other instance of that class. If you add instances to group-named classes, you can form groups by creating instances and assigning them identical names. All instances of a group-named class that have the same name form a group of instances.
remove	The "remove" command allows you to remove an existing instance of a class. remove unnamed-class [property value . . .] remove named-class instance | all [property value . . .] For example: remove radius-user wally

The CLI also includes the following commands for maintenance tasks:

CLI Command	Description
save-running	The save-running command saves the running configuration as the startup configuration. For more information, see "Saving Configuration Changes".
reboot	The reboot command restarts the access point (a "soft" reboot). For more information, see "Rebooting Access Point".
factory-reset	The factory-reset command resets the AP to factory defaults and reboots. For more information, see "Reset the AP to Factory Defaults".

Getting Help on Commands at the CLI

Help on commands can be requested at the command line interface (CLI) by using the TAB key. This is a quick way to see all valid completions for a class.

Hitting TAB once will attempt to complete the current command.

If multiple completions exist, a beep will sound and no results will be displayed. Enter TAB again to display all available completions.

- Example 1: At a blank command line, hit **TAB** twice to get a list of all commands.

```
AT-TQ2403#
add                 Add an instance to the running configuration
factory-reset       Reset the system to factory defaults
get                 Get property values of the running configuration
reboot              Reboot the system
remove              Remove instances in the running configuration
save-running        Save the running configuration
set                 Set property values of the running configuration
```

- Example 2: Type "**get** " TAB TAB (including a space after get) to see a list of all property options for the get command.

```
AT-TQ2403# get
access-point        Guest, VLAN and VWN settings
ap-list             AP list for rogue AP detection
association         Associated station
basic-rate          Basic rates of radios
bridge-port         Bridge ports of bridge interfaces
bss                 Basic Service Set of radios
channel-planner     Channel planner settings
cluster             Clustering-based configuration settings
config              Configuration settings
detected-ap         Detected access point
dhcp-client         DHCP client settings
dot11               IEEE 802.11 (all radios)
firmware-upgrade    Upgrade firmware of the AP through http
host                Internet host settings
interface           Network interface
ip-route            IP route entry
log                 Log settings
log-entry           Log entry
mac-acl             MAC address access list item
management          Management communication configurations
ntp                 Network Time Protocol client
portal              Guest captive portal
radio               Radio
radius-user         RADIUS user
serial              Serial access to the command line interface
snmp                SNMP (Simple Network Management Protocol)
ssh                 SSH access to the command line interface
static-ip-route     Static IP route entry - used when DHCP is off
supported-rate      Supported rates of radios
system              System settings
telnet              Telnet access to the command line interface
traphost            Destination host for SNMP traps
tx-queue            Transmission queue parameters
untagged-vlan       Untagged VLAN configuration
vwn                 Virtual Wireless Network
web-server          Web server
wme-queue           Transmission queue parameters for stations
```

- Example 3: Type "**get system v**" TAB. This will result in completion with the only matching

property, "**get system version**". Hit ENTER to display the output results of the command.

For detailed examples on getting help, see "Keyboard Shortcuts and Tab Completion Help".

Ready to Get Started?

If you know the four basic commands shown above (get, set, remove, and add) and how to get help at the CLI using tab completion, you are ready to get started.

The best way to get up-to-speed quickly is to bring up the CLI on your AP and follow along with some or all of the examples in the next topic "Command Usage and Configuration Examples".

Command Usage and Configuration Examples

Understanding Interfaces as Presented in the CLI

The table of interface names below, is provided to help clarify the related CLI commands and output results. These names are not exposed on the Web UI, but are used throughout the CLI. You get and set many configuration values on the AP by referring to interfaces. In order to configure the AP through the CLI, you need to understand which interfaces are available on the AP, what role they play (corresponding setting on the Web UI), and how to refer to them.

The Management Interface is the interface used to manage the access point. It is the interface that has an IP address assigned to it, and can be used for access to telnet, ssh, SNMP, the Web UI etc. Depending on the configuration of the access point, the Management Interface can change. To determine which interface is the management interface, use the command get management and look at the interface property. The management class also provides easy access to get and set the properties of the management interface, including its IP address.

Interface	Description
lo	Local loopback for data meant for the access point itself.
eth0	The primary wired (Ethernet) interface. This interface may receive untagged or both tagged and untagged packets, depending on the configuration. The packets may be bridged to wireless networks or used for management.
br0	The Internal bridge represents the Internal interface for the access point. br0 consists: • eth0 (or vlanSomeNumber if you have VLANs configured) • wlan0 • wlan1
brguest	The Guest bridge, which consists of eth1 (or VLAN xxxx if you have VLANs configured) and wlan0guest.
brtrunk	The Trunk bridge. When VLANs are in use, bridges tag packets between the interfaces that use them (eth0, wlan0wdsx).
brvlanxxxx	The bridge interface for the management VLAN using VLAN ID xxxx. This is only used when the management VLAN is not using an already existing bridge, for example, br0, brvwnx, etc.

Interface	Description
brvwnx	The bridge interface for Virtual Wireless Network (VWN) where "x" indicates the number of the VWN.
wlan0	The wireless (radio) interface for the Internal network.
wlan0guest	The wireless (radio) interface for the Guest network.
wlan0vwnx	The wireless interface for Virtual Wireless Network (VWN) where "x" indicates the number of the VWN.
wlan0wdsx	A wireless distribution system (WDS) interface where "x" indicates the number of the WDS link. (For example, wlan0wds1.)
wlan1	On a dual radio AP, the wireless (radio) interface for the Internal network on the second radio.
wlan1guest	On a dual radio AP, the wireless (radio) interface for the Guest network on the second radio.
wlan1vwnx	On a dual radio AP, the wireless interface for Virtual Wireless Network (VWN) where "x" indicates the number of the VWN.
vlanxxxx	A VLAN interface for VLAN ID xxxx. To find out what this VLAN interface is (Internal, Guest, Management), use the following command to look at the "**role**" property: get interface vlanVLANID role For example: get interface vlan1234 role

Understanding CLI Validation of Configuration Settings

The CLI performs validation on individual property values in a set or add, but does not check to see if different property values are consistent with each other. For example, it would not provide any error if a radio's mode was set to "a" and its channel was set to "1". (Even though "1" is not a valid channel in "a" mode, it is a valid channel in "g" mode.) In cases where the configuration is left in an inconsistent state, the services associated with the configuration may not be operational. Therefore, it is important to consult the class and property reference to understand the acceptable values for properties given the values of other properties. For more information, see "CLI Classes and Properties Reference".

Saving Configuration Changes

The AT-TQ2403 Management Software maintains three different configurations.

- **Factory Default Configuration** - This configuration consists of the default settings shipped with the access point.

  You can always return the AP to the factory defaults by using the **factory-reset** command, as described in "Reset the AP to Factory Defaults".

- **Startup Configuration** - The startup configuration contains the settings with which the AP will use the next time it starts up (for example, upon reboot).

  To save configuration updates made from the CLI to the *startup* configuration, you must execute the **save-running** or **set config startup running** command from the CLI after making changes.

- **Running Configuration** - The running configuration contains the settings with which the AP is currently running.

  When you view or update configuration settings through the command line interface (CLI) using **get**, **set**, **add**, and **remove** commands, you are viewing and changing values on the *running* configuration only. If you do not save the configuration (by executing the **save-running** or "**set config startup running**" command at the CLI), you will lose any changes you submitted via the CLI upon reboot.

The **save-running** command saves the running configuration as the startup configuration. (The save-running command is a shortcut command for "**set config startup running**", which accomplishes the same thing)

Settings updated from the CLI (with **get**, **set**, **add**, **remove** commands) will not be saved to the startup configuration unless you explicitly save them via the **save-running** command. This gives you the option of maintaining the startup configuration and trying out values on the running configuration that you can discard (by not saving).

By contrast, configuration changes updated from the Web UI are automatically saved to both the running and startup configurations. If you make changes from the Web UI that you do not want to keep, your only option is to reset to factory defaults. The previous startup configuration will be lost.

Basic Settings

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

The following CLI command examples correspond to tasks you can accomplish on the Basic Settings tab of the Web UI for access points with clustering capabilities. In some cases, the CLI **get** command provides additional details not available through the Web UI.

This table shows a quick view of Basic Settings commands and provides links to detailed examples.

Feature or Setting	CLI Command
Get the IP Address for an Access Point	get management ip or get management If management VLANs are not enabled, then the management interface will be **br0**. Therefore, it is also possible to use "**get interface br0 ip**" to get the IP address.
Get the MAC Address for an Access Point	get management mac
Get Both the IP Address and MAC Address	get management mac ip
Get Common Information on All Interfaces for an AP	get interface

Feature or Setting	CLI Command
Get the Firmware Version for the Access Point	get system version
Get the Location of the Access Point	get cluster location
Set the Location for an Access Point	set system location NewLocation For example: set system location hallway or set system location "*Vicky's Office*"
Set the Password	set system password NewPassword For example: set system password admin
Get the Wireless Network Name (SSID)	get interface wlan0 ssid
Set the Wireless Network Name (SSID)	set interface wlan0 ssid NewSSiD For example: set interface wlan0 ssid *Vicky* set interface wlan0 ssid "*Vicky's AP*"

Get the IP Address for an Access Point

In the following example, the IP address for the access point is: 192.168.1.230. Use the get command as shown to obtain the IP address for the management interface.

```
AT-TQ2403# get management ip
192.168.1.230
```

Get the MAC Address for an Access Point

In the following example, the MAC address for the access point is: 00:a0:c9:8c:c4:7e. Use the get command as shown to obtain the MAC address for the management interface.

```
AT-TQ2403# get management mac
00:a0:c9:8c:c4:7e
```

Get Both the IP Address and MAC Address

The following command returns both the IP address and the MAC address for an access point:

```
AT-TQ2403# get management ip mac
Property Value
```

```
---------------------
ip  10.10.55.216
mac         00:a0:c9:8c:c4:7e
```

Get Common Information on All Interfaces for an AP

The following example shows common information (including IP addresses) for all interfaces.

```
AT-TQ2403# get interface all
name                type            status  mac                ip              mask
-------------------------------------------------------------------------------------------------------------
wlan0wds0           wds             down
wlan0wds3           wds             down
wlan0wds2           wds             down
wlan0wds1           wds             down
wlan0vwn2           service-set     up
wlan1vwn10          service-set     up
wlan1vwn3           service-set     up
wlan0vwn4           service-set     up
wlan0vwn12          service-set     up
wlan0vwn1           service-set     up
wlan1vwn6           service-set     up
wlan0vwn3           service-set     up
wlan1vwn5           service-set     up
wlan1vwn9           service-set     up
wlan1vwn13          service-set     up
wlan0vwn11          service-set     up
wlan1vwn7           service-set     up
wlan0vwn14          service-set     up
wlan0               service-set     up      00:01:02:03:02:00  0.0.0.0
wlan1vwn1           service-set     up
wlan1vwn2           service-set     up
wlan0vwn9           service-set     up
wlan0vwn13          service-set     up
wlan0vwn6           service-set     up
wlan1vwn8           service-set     up
wlan0guest          service-set     up                         0.0.0.0
wlan1               service-set     up      00:01:02:03:02:10  0.0.0.0
wlan0vwn8           service-set     up
wlan0vwn5           service-set     up
wlan1vwn12          service-set     up
wlan1guest          service-set     up                         0.0.0.0
wlan1vwn11          service-set     up
wlan0vwn10          service-set     up
wlan1vwn4           service-set     up
wlan0vwn7           service-set     up
wlan1vwn14          service-set     up
brvwn7              bridge          down    00:00:00:00:00:00
brvwn6              bridge          down    00:00:00:00:00:00
brvwn10             bridge          down    00:00:00:00:00:00
brvwn13             bridge          down    00:00:00:00:00:00
br0                 bridge          up      00:01:02:03:02:00  192.168.1.230
255.255.255.0
brvwn3              bridge          down    00:00:00:00:00:00
brvwn9              bridge          down    00:00:00:00:00:00
brvwn8              bridge          down    00:00:00:00:00:00
brvwn11             bridge          down    00:00:00:00:00:00
brguest             bridge          down    00:00:00:00:00:00
brvwn5              bridge          down    00:00:00:00:00:00
brvwn2              bridge          down    00:00:00:00:00:00
```

```
brvwn12     bridge      down    00:00:00:00:00:00
brvwn1      bridge      down    00:00:00:00:00:00
brvwn4      bridge      down    00:00:00:00:00:00
brvwn14     bridge      down    00:00:00:00:00:00
lo          loopback    up      00:00:00:00:00:00   127.0.0.1       255.0.0.0
eth0        ethernet    up      00:5C:00:1C:00:1C
```

Get the Firmware Version for the Access Point

In the following example, the access point is running Firmware Version:1.0.0.9. Use the get command as shown to obtain the Firmware Version.

```
AT-TQ2403# get system version
1.0.0.9
```

Get the Location of the Access Point

In the following example, the location of the access point has not been set. Use the get command as shown to obtain the location of the access point.

```
AT-TQ2403# get cluster location
not set
```

Set the Location for an Access Point

To set the location for an access point, use the set command as follows:

```
AT-TQ2403# set cluster location "Vicky's Office"
```

To check to make sure that the location was set properly, use the get command again to find out the location

```
AT-TQ2403# get system location
Vicky's Office
```

Get the Current Password

For security reasons, you cannot directly retrieve the password of a device. If you forget the password of a device, and you have a CLI session, you can change the password to a new value. Alternatively, you can perform a factory reset to return the default password.

Although you cannot directly retrieve a password, you can retrieve an encrypted copy of it. This is useful if you want to set the same password on several different devices. In that case, you can get the encrypted password on one device, copy that value, and set the encrypted password to be the same value on other devices.

Note: If the devices are clustered, this happens in the background when you change the password. All passwords on the clustered devices will be the same.

```
AT-TQ2403# get system encrypted-password
n32Vbm2EMTkYY
```

Set the Password

```
AT-TQ2403# set system password admin
AT-TQ2403# get system encrypted-password
iHhzFIS22ACdk
```

Get the Wireless Network Name (SSID)

```
AT-TQ2403# get interface wlan0 ssid
allied
```

Set the Wireless Network Name (SSID)

```
AT-TQ2403# set interface wlan0 ssid "Vicky's AP"
AT-TQ2403# get interface wlan0 ssid
Vicky's AP
```

Access Point and Cluster Settings

The command examples in this section show how to get the configuration for a cluster of access points. These settings generally correspond to those on the **Cluster > Access Points** tab in the Web UI.

Note: You cannot use the CLI to add or remove an access point from a cluster or set the configuration policy. If you want to configure clustering, please use the Web User Interface as described in "Managing Access Points and Clusters".

This table provides a quick view of Access Point Cluster commands and links to detailed examples.

Feature or Setting	CLI Command
Determine if the AP is a Cluster Member or in Standalone Mode (whilst obtaining all cluster properties)	get cluster
Determine only whether an AP is clustered or not	get cluster clustered
Determine the name of the cluster your AP is part of	get cluster cluster-name
Determine the location of the AP that is part of the cluster	get cluster location

Determine if the AP is a Cluster Member or in Standalone Mode (whilst obtaining all cluster properties)

This get cluster command shows all the cluster properties associated with an AP. If the property clustered has a value of 0, then the AP is in stand-alone mode (i.e. not clustered). If the property clustered returns a value of 1, then the AP is a member of a cluster.

In the following example, the AP is in standalone mode.

```
AT-TQ2403# get cluster
Property    Value
--------------------------------
Clustered   0
location              not set
cluster-name          Default
```

In the following example, the AP is a member of a cluster, since a value of 1 has been returned.

```
AT-TQ2403# get cluster
Property    Value
-------------------------
clustered   1
location              Vicky's Office
```

cluster-name vicky-cluster

Determine only whether an AP is clustered or not

The get cluster clustered command returns a value of 0 or 1. If the command returns a value of 1, then the AP is a member of a cluster. If the AP returns a value of 0, then the AP is in standalone mode.

```
AT-TQ2403# get cluster clustered
1
```

Determine the name of the cluster your AP is part of

The get cluster cluster-name command tells you the name of the cluster your AP is part of. In the following example, the name of the cluster your AP is joined to is "vicky-cluster".

```
AT-TQ2403# get cluster cluster-name
vicky-cluster
```

Determine the location of the AP that is part of the cluster

If you have specified a location for the AP, you can determine this using the get cluster location command.

```
AT-TQ2403# get cluster location
Vicky's Office
```

User Accounts

The following command examples show configuration tasks related to user accounts. These tasks correspond to the **User Management** tab in the Web UI.

This table shows a quick view of User Management commands and provides links to detailed examples.

Feature or Setting	CLI Command
Get All User Accounts	To view all usernames: get radius-user all name To view all user account details: get radius-user all
Add Users:	add radius-user UserName For example: add radius-user *samantha*

Feature or Setting	CLI Command
To set the user's real name:	set radius-user UserName RealName For example: set radius-user samantha realname "*Elizabeth Montgomery*" or set radius-user samantha realname *Elizabeth Montgomery*
To set user's password:	set radius-user UserName password Password For example: set radius-user samantha password bewitched
Save the new user account details	save-running
Remove a User Account:	remove radius-user UserName

Get All User Accounts

To view all user names:

```
AT-TQ2403# get radius-user all name
samantha
```

To view all user accounts:

```
AT-TQ2403# get radius-user all
Property    Value
------------------------------
name        samantha
disabled    0
realname    Elizabeth Montgomery
```

(When we start out, "samantha" is the only user configured.)

Add Users

In this example, we will add four new users: (1) samantha, (2) endora, (3) darren, and (4) wally. We'll set up user names, real names, and passwords for each.

1. Add **username** "samantha":

   AT-TQ2403# add radius-user *samantha*

2. Provide a real name (Elizabeth Montgomery) for this user:

   AT-TQ2403# set radius-user samantha realname "*Elizabeth Montgomery*"

3. Set the user **password** for samantha to "bewitched"

```
AT-TQ2403# set radius-user samantha password bewitched
```

4. Repeat this process to add some other users (endora, darren, and wally)

```
AT-TQ2403# add radius-user endora
AT-TQ2403# set radius-user endora realname "Agnes Moorhead"
AT-TQ2403# set radius-user endora password scotch
AT-TQ2403# add radius-user darren
AT-TQ2403# set radius-user darren realname "Dick York"
AT-TQ2403# set radius-user darren password martini
AT-TQ2403# add radius-user wally
AT-TQ2403# set radius-user wally realname "Tony Dow"
AT-TQ2403# set radius-user wally password sodapop
```

Note: After you have added all the necessary users, use the **save-running** command to save the new radius-user accounts. If you do not run this command, all new radius-user accounts will be lost when you reboot the AP.

5. After configuring and saving these new accounts, use the **get** command to view all users.

```
AT-TQ2403# get radius-user all
name            disabled        realname
-------------------------------------------------------------------------------
Endora          0               Agnes Moorhead
Darren          0               Dick York
Samantha        0               Elizabeth Montgomery
wally           0               Tony Dow
```

Remove a User Account

To remove a user account, type the following

```
AT-TQ2403# remove radius-user wally
```

Use the **get** command to view all user names. (You can see "wally" has been removed.)

```
AT-TQ2403# get radius-user all name
name
--------
endora
darren
samantha
```

Status

The command tasks and examples in this section show status information on access points. These settings correspond to what is shown on the **Status** tabs in the Web UI. (See "Interfaces", "Event Logs", "Transmit/Receive Statistics", "Associated Wireless Clients", and "Neighboring Access Points".)

This table provides a quick view of all Status commands and links to detailed examples.

Feature or Setting	CLI Command
Understanding Interfaces as Presented in the CLI	Reference of interface names and purposes as described in "Understanding Interfaces as Presented in the CLI".

Feature or Setting	CLI Command
Global commands to get details on all Basic Service Sets (BSSs). This is a useful command to use to get a comprehensive picture of how the AP is currently configured.	get bss all detail get access-point get vwn
Get Information on the Management Interface for the AP	get management
Get Current Settings for the Ethernet (Wired) Guest Interface	get access-point get interface brguest get interface brguest mac get interface brguest ssid
Get the MAC Address for the Wireless Internal Interface	get interface wlan0 mac
Get the Network Name (SSID) for the Wireless Internal Interface	get interface wlan0 ssid
Get the Current IEEE 802.11 Radio Mode	get radio wlan0 mode
Get the Channel the AP is Currently Using	get radio wlan0 channel
Get Common Radio Settings for the First Radio	get radio wlan0 get radio wlan0 detail
Get Status on Events	get log-entry
Get Status on Persistence	get log persistence

Feature or Setting	CLI Command
Enable Remote Logging and Specify the Log Relay Host for the Log	As a prerequisite to remote logging, the Log Relay Host must be configured first as described in "Setting Up the Log Relay Host". See complete explanation of CLI commands at "Enable Remote Logging and Specify the Log Relay Host for the Log" Here are a few: set log relay-enabled 1 -enables remote logging set log relay-enabled 1 -disables remote logging get log set log -TAB TAB shows properties you can set on the log
Get Transmit / Receive Statistics	get interface all ip mac ssid tx-packets tx-bytes tx-errors rx-packets rx-bytes rx-errors
Get Client Associations	get association
Get Neighboring APs	get clustered-ap

Get Information on the Management Interface for the AP

The following command returns all information on the internal interface for an access point:

```
AT-TQ2403# get management
Property                          Value
--------------------------------------------------------------------------------
vlan-id
interface                         br0
static-ip                         192.168.1.230
static-mask                       255.255.255.0
ip                                192.168.1.230
mask                              255.255.255.0
mac                               00:01:02:03:02:00
dhcp-status                       down
management-ip-enabled             0
management-ip-address             192.168.1.1
deny-wlan-management-enabled      0
deny-wlan-management-ping         0
deny-wlan-management-telnet       0
deny-wlan-management-http         0
deny-wlan-management-snmp         0
deny-wlan-management-tftp         0
```

Get Current Settings for the Ethernet (Wired) Management Interface

The following example shows how to use the CLI to get the Ethernet (Wired) settings for the Management interface for an access point. You can see by the output results of the command that the MAC address is 00:01:02:03:02:00, the IP address is 192.168.1.230 and the subnet mask is 255.255.255.0.

Get All Wired Settings for the Wired Management Interface

The following command returns all information about wired settings for the Wired Management Interface.

```
AT-TQ2403# get management
Property                          Value
--------------------------------------------------------------------------------
vlan-id
interface                         br0
static-ip                         192.168.1.230
static-mask                       255.255.255.0
ip                                192.168.1.230
mask                              255.255.255.0
mac                               00:01:02:03:02:00
dhcp-status                       down
management-ip-enabled             0
management-ip-address             192.168.1.1
deny-wlan-management-enabled      0
deny-wlan-management-ping         0
deny-wlan-management-telnet       0
deny-wlan-management-http         0
deny-wlan-management-snmp         0
```

Get Current Settings for the Ethernet (Wired) Guest Interface

The following example shows how to use the CLI to get the Ethernet (Wired) settings for the Guest interface for an access point. You can see by the output results of the command that the MAC address is 00:50:04:6f:6f:90, the IP address is 10.10.56.248, and the subnet mask is 255.255.255.0.

```
AT-TQ2403# get interface brguest
Property  Value
----------------------------------------
type      bridge
status    down
mac       00:00:00:00:00:00
ip
mask
```

Note: You can get specifics on the Guest interface by using the same types of commands as for the Internal interface but substituting **wlan0guest** for **wlan0**. For example, to get the SSID for the guest interface: **get interface wlan0guest ssid**.

Get the MAC Address for the Wireless Internal Interface

The following example shows how to get the MAC address of a Wireless Internal Interface. You can see from the value that is returned, that the MAC address is 02:0C:41:00:02:00.

```
AT-TQ2403# get interface wlan0 mac
00:01:02:03:02:00
```

Get the Network Name (SSID) for the Wireless Internal Interface

The following example shows how to get the SSID of a Wireless Internal Interface. You can see from the value that is returned, that the SSID of this AP is "allied ".

```
AT-TQ2403# get interface wlan0 ssid
allied
```

Get current Wireless (Radio) Settings

The following examples show how to use the CLI to get wireless radio settings on an access point, such as mode, channel, and so on. You can see by the output results of the commands that the AP mode is set to IEEE 802.11g, the channel is set to 6, the beacon interval is 100, and so forth.

For information on how to configure Radio settings through the CLI, see "Radio Settings".

(Radio settings are fully described in the Web UI topic on "Configuring Radio Settings".)

Get the Current IEEE 802.11 Radio Mode

```
AT-TQ2403# get radio wlan0 mode
a
```

Get the Channel the AP is Currently Using

```
AT-TQ2403# get radio wlan0 channel
36
```

Get Common Radio Settings for the First Radio

```
AT-TQ2403# get radio wlan0
Property            Value
---------------------------------
status              up
mac                 00:01:02:03:02:00
channel-policy      static
mode                a
static-channel      36
channel             36
tx-rx-status        up
```

Get All Radio Settings on the First Radio

```
AT-TQ2403# get radio wlan0 detail
Property                        Value
-------------------------------------------------------------------------------
status                          up
description                     Radio 1 - IEEE 802.11a
mac                             00:01:02:03:02:00
max-bss                         16
channel-policy                  static
mode                            a
dot11h                          on
radar-detection                 on
block-time                      30
quiet-duration                  0
quiet-period                    0
tx-mitigation                   3
```

```
static-channel                          36
channel                                 36

Property                                Value
-------------------------------------------------------------------------------
tx-power                                100
tx-rx-status                            up
beacon-interval                         100
rts-threshold                           2347
fragmentation-threshold                 2346
super-ag                                no
atheros-xr                              no
load-balance-disassociation-utilization 0
load-balance-disassociation-stations    0
load-balance-no-association-utilization 0
ap-detection                            off
station-isolation                       off
frequency                               5180
wme                                     off
rate-limit-enable                       off
rate-limit                              50
rate-limit-burst                        75
```

Get Status on Events

```
AT-TQ2403# get log-entry
number    priority  time              daemon          message
-------------------------------------------------------------------------------------------------
1         info      Jan  1 00:04:51   login[289]      root login  on `ttyS0'
2         notice    Jan  1 00:02:07   syslog          Device boot up
3         info      Jan  1 00:02:06   dropbear[277]   Not forking
```

Get Status on Persistence

If Persistence is enabled, all logs become persistent and are written to NVRAM and after a reboot, all logs are recoverable from your system. Non-persistent logs are only kept during the run-time period. Therefore, if Persistence is disabled and you reboot the access point, all non-persistent logs will be lost. To determine the status of Persistence, use the following CLI command:

```
AT-TQ2403# get log persistence
no
```

Enable or Disable Persistence

In the above example Persistence is disabled. Suppose you want to enable Persistence to ensure that logs are written to NVRAM. Use the following command to enable Persistence:

```
AT-TQ2403# set log persistence on
```

Alternatively, if you wanted to disable Persistence, use the following CLI command:

```
AT-TQ2403# set log persistence off
```

Specify the Severity of Messages to be Displayed in the Event Log

The purpose of severity configuration is to filter or limit the security messages that are displayed in the Event log. It is unlikely that you will want to see a list of all messages. Those of less severity or significance can be filtered using the Severity Configuration feature.

You can set a Severity of between 0 (most severe) and 7 (least severe). Setting a Severity of 7 will result in all persistent messages being sent to the Event Log. However, if you set a Severity of 4, only messages with a Severity between 0 and 4 will be sent to the Event Log. To find out the current Severity level set for the AP, use the following command:

```
AT-TQ2403# get log severity
7
```

Suppose you only want to retrieve messages with a Severity of 5 or more, use the following CLI command:

```
AT-TQ2403# set log severity 5
```

Specify the Depth of the Event Log

The value specified for Depth determines the number of log entries that can be saved to NVRAM. You can save up to a maximum of 128 entries. To determine the current Depth setting, use the following command:

```
AT-TQ2403# get log depth
128
```

Suppose you want to limit the Depth of the log entries saved to NVRAM to 99. Use the following CLI command to do this.

```
AT-TQ2403# set log depth 99
```

Enable Remote Logging and Specify the Log Relay Host for the Log

The Log is a list of system messages, such as error conditions like dropping frames. To capture Access Point Log messages you need access to a remote syslog server on the network. The following sections describe how to set up remote logging for the AP.

1. Prerequisites for Remote Logging
2. View Log Settings
3. Enable / Disable Log Relay Host
4. Specify the Relay Host
5. Specify the Relay Port
6. Review Log Settings After Configuring Log Relay Host

Prerequisites for Remote Logging

To capture Log messages from the access point system, you must first set up a remote server running a syslog process and acting as a syslog "log relay host" on your network. (For information on how to set up the remote server, see “Setting Up the Log Relay Host”.)

Then, you can use the CLI to configure the AT-TQ2403 Management Software to send its syslog messages to the remote server.

View Log Settings

To view the current log settings:

```
AT-TQ2403# get log
Property            Value
----------------------------------
depth               128
persistence         no
severity            7
relay-enabled       0
relay-host
relay-port          514
```

When you start a new AP, the Log Relay Host is disabled. From the above output for the "get log" command, you can identify the following about the Log Relay Host (syslog server):

- The syslog server is *disabled* (because "relay-enabled" is set to "0")
- No IP address or Host Name is specified for the syslog server.
- The AP is listening for syslog messages on the default port 514

Enable / Disable Log Relay Host

To enable the Log Relay Host:

```
AT-TQ2403# set log relay-enabled 1
```

To disable the Log Relay Host:

```
AT-TQ2403# set log relay-enabled 0
```

Specify the Relay Host

To specify the Relay Host, provide either the IP Address or a DNS name for the Log Relay Host as parameters to the "**set log relay-host**" command as shown below.

Note: If you are using AT-TQ2403 Wireless Operations Center, the Repository Server should receive the syslog messages from all access points. In this case, use the IP address of the Operations Center Repository Server as the Relay Host.

- To specify an IP address for the syslog server:

  ```
  set log relay-host IP_Address_Of_LogRelayHost
  ```

  Where IP_Address_Of_LogRelayHost is the IP Address of the Log Relay Host.

  For example:

  ```
  AT-TQ2403# set log relay-host 10.10.5.220
  ```

- To specify a Host Name for the syslog server:

  ```
  set log relay-host Host_Name_Of_LogRelayHost
  ```

  Where Host_Name_Of_LogRelayHost is the DNS name for the Log Relay Host.

  For example:

```
AT-TQ2403# set log relay-host myserver
```

Specify the Relay Port

To specify the Relay Port for the syslog server:

```
set log relay-port Number_Of_LogRelayPort
```

Where Number_Of_LogRelayPort is the port number for the Log Relay Host.

For example:

```
AT-TQ2403# set log relay-port 514
```

Review Log Settings After Configuring Log Relay Host

To view the current log settings:

```
AT-TQ2403# get log
Property            Value
----------------------------------
depth               128
persistence         no
severity            7
relay-enabled       1
relay-host          myserver
relay-port          514
```

From the above output for the "**get log**" command, you can identify the following about the Log Relay Host (syslog server):

- The syslog server is enabled (because "relay-enabled" is set to "1")
- The syslog server is at the IP address 10.10.5.220
- The AP is listening for syslog messages on the default port 514

Get Transmit / Receive Statistics

```
AT-TQ2403# get interface wlan1 ip mac ssid tx-packets tx-bytes tx-errors rx-packets
rx-bytes                                                                    rx-errors
Property            Value
----------------------------------
ip                  0.0.0.0
mac                 00:01:02:03:02:10
ssid                allied
tx-packets          191
tx-bytes            30336
tx-errors           0
rx-packets          188
rx-bytes            26818

 rx-errors          0
```

Get Client Associations

```
AT-TQ2403# get association
interface    station              authenticated    associated        rx-packets
```

```
   tx-packets
-------------------------------------------------------------------------------------------------------------
wlan1       00:0e:35:48:a7:ea  Yes              Yes              98               1
wlan1       00:11:95:df:83:b1  Yes              Yes              320              27

AT-TQ2403# get association detail
Property            Value
----------------------------------
interface           wlan1
station             00:0e:35:48:a7:ea
authenticated       Yes
associated          Yes
rx-packets          98
tx-packets          1
rx-bytes            15880
tx-bytes            78
tx-rate             540
listen-interval     10
last-rssi           44

Property            Value
----------------------------------
interface           wlan1
station             00:11:95:df:83:b1
authenticated       Yes
associated          Yes
rx-packets          322
tx-packets          29
rx-bytes            20910
tx-bytes            2336
tx-rate             540
listen-interval     10
last-rssi           41
```

Get Neighboring APs

The Neighboring AP view shows wireless networks within range of the access point. These commands provide a detailed view of neighboring APs including identifying information (SSIDs and MAC addresses) for each, and statistical information such as the channel each AP is broadcasting on, signal strength, and so forth.

To see the kinds of information about AP neighbors you can search on, type **get detected-ap** TAB TAB.

```
AT-TQ2403# get detected-ap
 [Enter]            * Get common properties *
band                Frequency band
beacon-interval     Beacon interval in kus (1.024 ms)
beacons             Number of beacons received
capability          IEEE 802.11 capability value
channel             Channel
detail              * Get all properties *
erp                 ERP
last-beacon         Time of last beacon
mac                 MAC address
phy-type            PHY mode detected with
privacy             WEP or WPA enabled
radio               Radio detected with
rate                Rate
signal              Signal strength
```

ssid	Service Set IDentifier (a.k.a., Network Name)
supported-rates	Supported rates list
type	Type (AP, Ad hoc, or Other)
wpa	WPA security enabled

To get the neighboring access points, type **get detected-ap**.

```
AT-TQ2403# get detected-ap
mac               type    privacy  ssid                        channel   signal
-------------------------------------------------------------------------------------------------
00:0a:79:5b:fe:43 AP      On       ATTW-OFFICE                 6         3
00:0a:79:94:ae:93 AP      Off      LANKom Electronics Co., Ltd. 6        7
00:01:02:03:03:10 AP      Off      allied                      6         4
00:0a:79:98:0d:f7 AP      Off      GO                          6         14
00:01:02:03:aa:10 AP      Off      developing                  6         20
00:01:02:03:03:00 AP      Off      allied                      36        12
```

Ethernet (Wired) Interface

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

This table shows a quick view of commands for getting and setting values for the Wired interface and links to detailed examples.

Feature or Setting	CLI Command
Get the DNS Name	get host id
Set the DNS Name	set host id HostName For example: set host id vicky-ap
Get Wired Internal Interface Settings	See "Get Current Settings for the Ethernet (Wired) Management Interface" under Status.
Get Wired Internal Guest Settings	"Get Current Settings for the Ethernet (Wired) Guest Interface" under Status.
Secure Management	Enable: set management management-ip-enabled 1
Specify client to manage access point	set management management-ip-addres MGMT_IP_Addr For example: set management management-ip-address 192.168.1.1

Feature or Setting	CLI Command
Deny Management via WLAN	Enable: set management deny-wlan-management-enabled 1
Ping Telnet HTTP SNMP TFTP	Deny: set management deny-wlan-management-ping 1 set management deny-wlan-management-telnet 1 set management deny-wlan-management-http 1 set management deny-wlan-management-snmp 1 set management deny-wlan-management-tftp 1
Get/Change the Connection Type (DHCP or Static IP)	See detailed example in "Get/Change the Connection Type (DHCP or Static IP)".
Re-Configure Static IP Addressing Values	For detailed examples see: "Set the Static IP Address" "Set the Static Subnet Mask Address" "Set the IP Address for the Default Gateway"
Set DNS Nameservers to Use Static IP Addresses (Dynamic to Manual Mode)	See example below.
Set DNS Nameservers to Use DHCP IP Addressing (Manual to Dynamic	See example below.
Configure VWNs	See "Configuring Virtual Wireless Networks(VWNs)"

Get the DNS Name

```
AT-TQ2403# get host id
AT-TQ2403
```

Set the DNS Name

```
AT-TQ2403# set host id vicky-ap
vicky-ap# get host id
vicky-ap
```

Get/Change the Connection Type (DHCP or Static IP)

Note: For more information on DHCP and Static IP connection types, see the topic "Understanding Dynamic and Static IP Addressing on the AT-TQ2403 Management Software".

To get the connection type:

```
AT-TQ2403# get management dhcp-status
up
```

In order to re-set the connection type from DHCP to Static IP, you must have a serial port connection to the AP because you will lose connectivity during the process of assigning a new static IP address.

To reset the connection type from DHCP to Static IP:

1. Disable DHCP:

   ```
   AT-TQ2403# set management dhcp-status down
   ```

2. Assign a static IP address:

   ```
   AT-TQ2403# set management static-ip 10.10.12.221
   ```

3. Add a route to the default gateway:

   ```
   set static-ip-route gateway IPAddressOfDefaultGateway
   ```

   For example:

   ```
   AT-TQ2403# set static-ip-route gateway 10.10.12.1
   ```

To reset the connection type from Static IP to DHCP:

```
AT-TQ2403# set management dhcp-status up
```

To view the new settings:

```
AT-TQ2403# get management
Property                          Value
-----------------------------------------------------------------
vlan-id
interface                         br0
static-ip                         192.168.1.230
static-mask                       255.255.255.0
ip                                192.168.199.54
mask                              255.255.255.0
mac                               00:01:02:03:02:00
dhcp-status                       up
management-ip-enabled             0
management-ip-address             192.168.1.1
deny-wlan-management-enabled      0
deny-wlan-management-ping         0
deny-wlan-management-telnet       0
deny-wlan-management-http         0
deny-wlan-management-snmp         0
deny-wlan-management-tftp         0
```

Re-Configure Static IP Addressing Values

Note: This section assumes you have already set the AP to use Static IP Addressing and set some initial values as described in "Get/Change the Connection Type (DHCP or Static IP)".

If you are using static IP addressing on the access point (instead of DHCP), you may want to reconfigure the static IP address, subnet mask, default gateway, or DNS name servers.

The following examples show how to change these values from the CLI. With the exception of DNS name servers, these values can only be reconfigured if you are using Static IP Addressing mode.

You do have the option of manually configuring DNS name servers for either a DHCP or Static IP connection type, so that task is covered in a separate section following this one.

Set the Static IP Address

1. Check to see what the current static IP address is. (In this example, the current static IP address is the factory default.)

```
AT-TQ2403# get management static-ip
192.168.1.230
```

2. Re-set to a new static IP address:

```
AT-TQ2403# set management static-ip 192.168.1.231
```

Set the Static Subnet Mask Address

1. Check to see the current Subnet Mask. (In this example, the current subnet mask is the factory default.)

```
AT-TQ2403# get management static-mask
255.255.255.0
```

2. Re-set to a new static Subnet Mask:

```
AT-TQ2403# set management static-mask 255.255.255.0
```

Set the IP Address for the Default Gateway

This example sets the Default Gateway to 192.168.1.254:

```
AT-TQ2403# set static-ip-route gateway 192.168.1.254
```

Set DNS Nameservers to Use Static IP Addresses (Dynamic to Manual Mode)

This example shows how to reconfigure DNS Nameservers from Dynamic mode (where name server IP addresses are assigned through DHCP) to Manual mode, and specify static IP addresses for them.

1. Check to see which mode the DNS Name Service is running in. (In our example, DNS naming is running in DHCP mode when we start because the following command returns upfor the mode.)

```
AT-TQ2403# get host dns-via-dhcp
up
```

2. Turn off Dynamic DNS Nameservers and re-check the settings:

```
AT-TQ2403# set host dns-via-dhcp down
AT-TQ2403# get host dns-via-dhcp
down
```

3. Get the current IP addresses for the DNS Nameservers:

```
AT-TQ2403# get host static-dns-1
10.10.3.9

AT-TQ2403# get host static-dns-2
10.10.3.11
```

4. Re-set the IP addresses for the DNS Nameservers as desired:

```
AT-TQ2403# set host static-dns-1 10.10.3.10
AT-TQ2403# get host static-dns-1
10.10.3.10

AT-TQ2403# set host static-dns-2 10.10.3.12
AT-TQ2403# get host static-dns-2
10.10.3.12
```

Set DNS Nameservers to Use DHCP IP Addressing (Manual to Dynamic Mode)

To switch DNS Nameservers from Manual (static IP addresses) to Dynamic mode (nameserver addresses assigned by DHCP), use the reverse command and check to see the new configuration:

```
AT-TQ2403# set host dns-via-dhcp up
AT-TQ2403# get host dns-via-dhcp
up
```

Wireless Interface

To set up a wireless (radio) interface, configure the following on each interface (Internal or Guest) as described in other sections of this CLI document.

- Configure the Radio Mode and Radio Channel as described in "Configure Radio Settings".
- Configure the Network Name as described in "Set the Wireless Network Name (SSID)".

Guest Access

The following sections explain how to get current status of the relevant settings, enable Guest Access, and set up guest networks using VLAN solution:

- Find out if Guest Access is Enabled
- Enable or Disable Guest Access
- Find out if Guest Access is set up on a VLAN
- Enable / Configure Guest Access on VLANs

Note:

- Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".
- After you configure the Guest Network (as described in the sections below), you can enable a "captive portal" Welcome page for guest clients who are using the Web over your Guest network. You can modify the Welcome page text that is displayed to guests when they log on to the Web. For more information, see "Enable/Configure Guest Login Welcome Page".
- For general information on configuring VWNs see "Configuring Virtual Wireless Networks (VWNs)" and "Example: Configuring VWNs".
- For information on how to set up Guest Access from the Web UI see the topics "Setting the Ethernet (Wired) Interface" and "Setting up Guest Access".

Find out if Guest Access is Enabled

The AT-TQ2403 Management Software ships with the Guest Access feature disabled by default. If you want to provide guest access on your AP you must enable this feature. For more information on enabling or disabling Guest Access, see "Enable or Disable Guest Access".

```
AT-TQ2403# get access-point guest-status
down
```

Enable or Disable Guest Access

If you want to provide guest access on your AP, use the following CLI command to enable it.

```
AT-TQ2403# set access-point guest-status up
```

Find out if Guest Access is set up on a VLAN or the second Ethernet Port

Use the following command to determine if Guest Access is set up on a VLAN or the second Ethernet Port.

```
AT-TQ2403# get access-point guest-via
ethernet
```

Enable / Configure Guest Access on VLANs

Caution:

- You cannot use a ssh or telnet connection to configure VLANs, because you will lose network connectivity to the access point when you remove the bridge-port. Therefore, you must use a serial port connection to configure VLANs through the CLI.
- Be sure to verify that the switch and DHCP server you are using can support VLANs per the IEEE 802.1Q standard. After configuring the VLAN on the Ethernet (Wired) Settings page, physically reconnect the Ethernet cable on the switch to the tagged packet (VLAN) port. Then, re-connect via the Administration Web pages to the new IP address. (If necessary, check with the infrastructure support administrator regarding the VLAN and DHCP configurations.)

This example assumes you start with Guest Access "down" and provides commands to enable it on VLANs.

1. Get the current status of Guest Access (it is "down" or disabled when we start):

```
AT-TQ2403# get access-point guest-status
down
```

2. Enable Guest Access on the VLAN. (In the first command, *XXXX*should be replaced by the VLAN ID you want to give to the Guest port.

```
AT-TQ2403# set vwn guest vlan-id XXXX
AT-TQ2403# set access-point guest-via vlan
AT-TQ2403# set access-point guest-status up
```

Enable/Configure Guest Login Welcome Page

- View Guest Login Settings
- Enable/Disable the Guest Welcome Page
- Set Guest Welcome Page Text
- Review Guest Login Settings

Note: Guest Login settings are only relevant if you have first configured a Guest Network. For information about configuring a Guest Network, see "Guest Access".

You can set up a "captive portal" that Guest clients will see when they log on to the Guest network. Or modify the Welcome screen guest clients see when they open a Web browser or try to browse the Web.

View Guest Login Settings

To view the current settings for Guest Login:

```
AT-TQ2403# get portal
Property                Value
-------------------------------------------------------------------------
status                  down
welcome-screen          off
```

welcome-screen-text Thank you for using wireless Guest Access as provided by this AT-TQ2403. Upon clicking "Accept", you will gain access to our wireless guest network. This network allows complete access to the Internet but is external to the corporate network. Please note that this network is not configured to provide any level of wireless security.

Enable/Disable the Guest Welcome Page

To enable the Guest welcome page:

```
AT-TQ2403# set portal status up
```

To disable the Guest welcome page:

```
AT-TQ2403# set portal status down
```

Set Guest Welcome Page Text

To specify the text for the Guest welcome page:

```
AT-TQ2403# set portal welcome-screen-text "Welcome to the Bewitched Network"
```

Review Guest Login Settings

The following example shows the results of the "set portal" command after specifying some new settings:

```
AT-TQ2403# get portal
Property                Value
------------------------------------------------------
status                  up
welcome-screen          on
welcome-screen-text     Welcome to the Bewitched Network
```

Configuring Virtual Wireless Networks (VWNs)

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

To configure additional networks on VLANs, you must first enable Virtual Wireless Networks. You can add up to a maximum of 14 VWNs.

Feature or Setting	CLI Command
Find out whether VWNs are enabled or not	get access-point vwn-status

Feature or Setting	CLI Command
Enable or Disable a VWN	set vwn vwnx status up This will enable VWN x. set vwn vwnx status down This will disable VWN x. Where x is the VWN number. The VWN number can be between 1 and 14.
Get the VLAN ID of a VWN	get vwn vwnx vlan-id Where x is the VWN number. The VWN number can be between 1 and 14.
Set the VLAN ID of a VWN	set vwn vwnx vlan-id Where vlan-id is a value between 1 and 4096.
Get the SSID of a VWN	get interface wlan0vwnx ssid Where x is the VWN number. The VWN number can be between 1 and 14.
Set the SSID for a VWN	set interface wlan0vwnx ssid ssid set interface wlan1vwnx ssid ssid (You must set the SSID on both radios on an AP) Where x is the VWN number and ssid is the ssid for the VWN. The VWN number can be between 1 and 14. The ssid can be any alphanumberic string up to 32 characters.
Determine whether Broadcast SSID is enabled	get bss wlan0bssvwn<x> ignore-broadcast-ssid
Enable or Disable the Broadcast SSID	Disable Broadcast SSID set bss wlan0bssvwnx ignore-broadcast-ssid on set bss wlan1bssvwnx ignore-broadcast-ssid on (You must disable both radios) Enable Broadcast SSID set bss wlan0bssvwnx ignore-broadcast-ssid off set bss wlan1bssvwnx ignore-broadcast-ssid off (You must enable both radios)

Feature or Setting	CLI Command
Configure Security on the VWN	Configuring security on a VWN is the same process as configuring security on an access point. The same options are available. For more information, see "Configure Security on the VWN".

Find out whether VWNs are enabled or not

Use the following command to determine if VWNs are enabled. If status is "down", VWNs are disabled. If status is "up", VWNs are enabled.

```
AT-TQ2403# get access-point vwn-status
up
```

If VWNs are enabled (up), then you can see whether an individual VWN is enabled by using the command "get vwn vwnx status" where x is the VWN number (1-14).

For example, you can determine the status of VWN 14 with the following command:

```
AT-TQ2403# get vwn vwn14 status
down
```

Enable or Disable a VWN

It is good practice to completely set up all VWNs before you enable any of them. This is because you should not expose partially configured VWNs. Once all VWNs are configured, you can up bring each one with the following command:

```
AT-TQ2403# set vwn vwnx status up
```

where x is the VWN number (1-14)

Alternatively, if you want to disable a VWN, use the following CLI command:

```
AT-TQ2403# set vwn vwnx status down
```

Get the VLAN ID of a VWN

To determine the VLAN ID of a VWN, use the following CLI command:

```
AT-TQ2403# get vwn vwn14 vlan-id
2054
```

Set the VLAN ID of a VWN

Setting a VLAN ID causes the AP to send DHCP requests with a VLAN tag. The switch and the DHCP server must support VLAN IEEE 802.1Q frames, and the AP must be able to reach the DHCP server. You can set the VLAN ID to any number between 1 and 4096.

To set the VLAN ID of a VWN to 25, use the following CLI command:

```
AT-TQ2403# set vwn vwn25 vlan-id 2054
```

Get the SSID of a VWN

In this example, suppose you want to determine the SSID of VWN 14 on an AP.

```
AT-TQ2403# get interface wlan0vwn14 ssid
myoffice
```

Set the SSID for a VWN

The SSID for a wireless network can be any alphanumeric string, up to a maximum of 32 characters. The SSID you set for a particular VWN will apply to all APs in the cluster. If you add any additional APs to that cluster, they too will share the SSID you set.

To set the SSID for a VWN to "test lab vwn", use the following CLI command:

```
AT-TQ2403# set interface wlan0vwn14 ssid "test lab vwn"
AT-TQ2403# set interface wlan1vwn14 ssid "test lab vwn"
```

Determine whether Broadcast SSID is enabled

To determine whether the Broadcast SSID for a VWN 12 is enabled, use the following CLI command:

```
AT-TQ2403# get bss wlan0bssvwn12 ignore-broadcast-ssid
off
```

Enable or Disable the Broadcast SSID

By default, the AP broadcasts its SSID in its beacon frames. If you want to prevent other stations from discovering your AP on the network, you can disable the broadcast of the SSID. When the broadcast SSID is disabled, your network name is not displayed in the List of Available Networks on a client station.

Suppose you don't want other stations on a network to detect your AP. Use the following CLI command to disable the broadcast SSID

```
AT-TQ2403# set bss wlan0bssvwn12 ignore-broadcast-ssid on
```

Alternatively, to enable the broadcast ssid, use the following CLI command:

```
AT-TQ2403# set bss wlan0bssvwn12 ignore-broadcast-ssid off
```

If you need to disable the broadcast SSID, you must disable both radios. Therefore you would use the same command as, and also the following command:

```
AT-TQ2403# set bss wlan1bssvwn12 ignore-broadcast-ssid on
```

Similarly, if you want to enable the broadcast SSID, use the command to enable AP, and also use the following command:

```
AT-TQ2403# set bss wlan1bssvwn12 ignore-broadcast-ssid off
```

Configure Security on the VWN

You can set a different type of security on each VWN. The configuration of security on a VWN is virtually the same as configuring security on an access point. All the available options for configuring security on the access point are available for configuring security on the VWN. The only difference in configuration is that when you configure security on a VWN, rather than simply using wlan0 in your CLI command, you will use wlan0vwn<x>. Similarly, rather than using wlan1 in your CLI command, you will

use wlan1vwn<x>. For information on the options for configuring security on an access point, see "Security".

When configuring Security on a VWN, use the same commands as setting Security on an access point, remembering to make the following substitutes:

- In the CLI commands, replace wlan0with wlan0vwn<*x*>
- In the CLI commands, replace wlan1with wlan1vwn<*x*>

Example: Configuring VWNs

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

Configuring VWN "One" on a Single Radio AP

1. Use the CLI to configure Security on the interface.

   The following example shows commands for configuring WPA/WPA2 Enterprise (RADIUS) security mode, allowing "Both" WPA and WPA2 clients to authenticate and using a TKIP cipher suite:

   ```
   AT-TQ2403# set bss wlan0bssvwn1 open-system-authentication on
   AT-TQ2403# set bss wlan0bssvwn1 shared-key-authentication on
   AT-TQ2403# set bss wlan0bssvwn1 wpa-allowed on
   AT-TQ2403# set bss wlan0bssvwn1 wpa2-allowed on
   AT-TQ2403# set bss wlan0bssvwn1 wpa-cipher-tkip on
   AT-TQ2403# set bss wlan0bssvwn1 wpa-cipher-ccmp off
   AT-TQ2403# set bss wlan0bssvwn1 radius-ip 127.0.0.1
   AT-TQ2403# set bss wlan0bssvwn1 radius-key secret
   AT-TQ2403# set bss wlan0bssvwn1 status up
   AT-TQ2403# set interface wlan0vwn1 security wpa-enterprise
   ```

2. Use the CLI to set the Network Name (SSID) for the new Virtual Wireless Network:

   ```
   AT-TQ2403# set interface wlan0vwn1 ssid my-vwn-one
   ```

3. Use the CLI to configure VWN 1.

   ```
   AT-TQ2403# set vwn internal vlan-id 1234
   AT-TQ2403# set access-point vwn-status up
   AT-TQ2403# set vwn vwn1 vlan-id 3678
   AT-TQ2403# set vwn vwn1 status up
   ```

Configuring VWN "Seven" on a Dual Radio AP

To configure the second Virtual Wireless Network, repeat the following steps:

1. Use the CLI to configure Security on the interface.

   The following example shows commands for configuring WPA/WPA2 Enterprise (RADIUS) security mode, allowing "Both" WPA and WPA2 clients to authenticate and using a TKIP cipher

suite:

```
AT-TQ2403# set bss wlan0bssvwn7 open-system-authentication on
AT-TQ2403# set bss wlan1bssvwn7 open-system-authentication on
AT-TQ2403# set bss wlan0bssvwn7 shared-key-authentication on
AT-TQ2403# set bss wlan1bssvwn7 shared-key-authentication on
AT-TQ2403# set bss wlan0bssvwn7 wpa-allowed on
AT-TQ2403# set bss wlan1bssvwn7 wpa-allowed on
AT-TQ2403# set bss wlan0bssvwn7 wpa2-allowed on
AT-TQ2403# set bss wlan1bssvwn7 wpa2-allowed on
AT-TQ2403# set bss wlan0bssvwn7 wpa-cipher-tkip on
AT-TQ2403# set bss wlan1bssvwn7 wpa-cipher-tkip on
AT-TQ2403# set bss wlan0bssvwn7 wpa-cipher-ccmp off
AT-TQ2403# set bss wlan1bssvwn7 wpa-cipher-ccmp off
AT-TQ2403# set bss wlan0bssvwn7 radius-ip 127.0.0.1
AT-TQ2403# set bss wlan1bssvwn7 radius-ip 127.0.0.1
AT-TQ2403# set bss wlan0bssvwn7 radius-key secret
AT-TQ2403# set bss wlan1bssvwn7 radius-key secret
AT-TQ2403# set bss wlan0bssvwn7 status up
AT-TQ2403# set bss wlan1bssvwn7 status up
AT-TQ2403# set interface wlan0vwn7 security wpa-enterprise
AT-TQ2403# set interface wlan1vwn7 security wpa-enterprise
```

2. Use the CLI to set the Network Name (SSID) for the seventh Virtual Wireless Network:

```
AT-TQ2403# set interface wlan0vwn7 ssid my-vwn-two
AT-TQ2403# set interface wlan1vwn7 ssid my-vwn-two
```

3. Use the CLI to configure VWN 7.

```
AT-TQ2403# set vwn internal vlan-id 2044
AT-TQ2403# set access-point vwn-status up
AT-TQ2403# set vwn vwn7 vlan-id 3224
AT-TQ2403# set vwn vwn7 status up
```

Security

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

The following sections show examples of how to use the CLI to view and configure security settings on the access point. These settings correspond to those available from the Web UI on the Security tab. For a detailed discussion of concepts and configuration options, see "Configuring Security".

This section focuses on configuring security on the Internal network. (Security on the Guest network defaults to plain-text. See "When to Use Unencrypted (No Security)".)

This table shows a quick view of Security commands and links to detailed examples.

Feature or Setting	CLI Command
Get the Current Security Mode	get interface wlan0 security

Feature or Setting	CLI Command
Get Detailed Description of Current Security	get bss wlan0bssInternal detail get interface wlan0 detail
Set the Broadcast SSID (Allow or Prohibit)	set bss wlan0bssInternal ignore-broadcast-ssid on set bss wlan0bssInternal ignore-broadcast-ssid off
Enable / Disable Station Isolation	AT-TQ2403# set radio wlan0 station-isolation on AT-TQ2403# set radio wlan0 station-isolation off
Set Security to Plain Text	set interface wlan0 security plain-text
Set Security to Static WEP	See detailed example in "Set Security to Static WEP"
Set Security to IEEE 802.1x	See detailed example in "Set Security to IEEE 802.1x".
Set Security to WPA/WPA2 Personal (PSK)	See detailed example in "Set Security to WPA/WPA2 Personal (PSK)"
Set Security to WPA/WPA2 Enterprise	See detailed example in "Set Security to WPA/WPA2 Enterprise (RADIUS)"

Get the Current Security Mode

```
AT-TQ2403# get interface wlan0 security
plain-text
```

Get Detailed Description of Current Security Settings

```
AT-TQ2403# get bss wlan0bssInternal detail
Property                    Value
------------------------------------------------
status                      up
description                 Internal
radio                       wlan0
beacon-interface            wlan0
mac                         00:01:02:03:02:00
dtim-period                 2
max-stations                2007
ignore-broadcast-ssid       off
mac-acl-mode                deny-list
mac-acl-name                default
radius-accounting           off
radius-ip                   127.0.0.1
radius-key                  secret
radius-port                 1812
radius-accounting-port      1813
vlan-tagged-interface       br0
open-system-authentication  on
shared-key-authentication   off
wpa-allow-non-wpa-stations  off
wpa-cipher-tkip             on
```

```
wpa-cipher-ccmp          off
wpa-allowed              on
wpa2-allowed             on
rsn-preauthentication    off
```

Set the Broadcast SSID (Allow or Prohibit)

To set the Broadcast SSID to on (allow):

```
AT-TQ2403# set bss wlan0bssInternal ignore-broadcast-ssid on
```

To set the Broadcast SSID to off (prohibit):

```
AT-TQ2403# set bss wlan0bssInternal ignore-broadcast-ssid off
```

Enable / Disable Station Isolation

```
AT-TQ2403# get interface br0 port-isolation
off
AT-TQ2403# set radio wlan0 station-isolation off
AT-TQ2403# get radio wlan0 detail
Property                                Value
-----------------------------------------------------------------------------------------
status                                  up
description                             Radio 1 - IEEE 802.11a
mac                                     00:01:02:03:02:00
max-bss                                 16
channel-policy                          static
mode                                    a
dot11h                                  on
radar-detection                         on
block-time                              30
quiet-duration                          0
quiet-period                            0
tx-mitigation                           3
static-channel                          36
channel                                 36
tx-power                                100
tx-rx-status                            up
beacon-interval                         100
rts-threshold                           2347
fragmentation-threshold                 2346
super-ag                                no
atheros-xr                              no
load-balance-disassociation-utilization 0
load-balance-disassociation-stations    0
load-balance-no-association-utilization 0
ap-detection                            off
station-isolation                       off
frequency                               5180
wme                                     off
rate-limit-enable                       off
rate-limit                              50
rate-limit-burst                        75
```

Set Security to Plain Text

```
AT-TQ2403# set interface wlan0 security plain-text
```

Set Security to Static WEP

1. Set the Security Mode
2. Set the Transfer Key Index
3. Set the Key Length
4. Set the Key Type
5. Set the WEP Keys
6. Set the Authentication Algorithm
7. Get Current Security Settings After Re-Configuring to Static WEP Security Mode

1. Set the Security Mode

```
AT-TQ2403# set interface wlan0 security static-wep
```

2. Set the Transfer Key Index

The following commands set the Transfer Key Index to 4.

```
AT-TQ2403# set interface wlan0 wep-default-key 1
AT-TQ2403# set interface wlan0 wep-default-key 2
AT-TQ2403# set interface wlan0 wep-default-key 3
AT-TQ2403# set interface wlan0 wep-default-key 4
```

3. Set the Key Length

For the CLI, valid values for Key Length are 40 bits or 104 bits.

Note: The Key Length values used by the CLI do not include the initialization vector in the length. On the Web UI, longer Key Length values may be shown which include the 24-bit initialization vector. A Key Length of 40 bits (not including initialization vector) is equivalent to a Key Length of 64 bits (with initialization vector). A Key Length of 104 bits (not including initialization vector) is equivalent to a Key Length of 128 bits (which includes the initialization vector).

To set the WEP Key Length, type one of the following commands:

Feature or Setting	CLI Command
To set the WEP Key Length to 40 bits:	set interface wlan0 wep-key-length 40
To set the WEP Key Length to 104 bits:	set interface wlan0 wep-key-length 128
To set the WEP Key Length to 152 bits:	set interface wlan0 wep-key-length 152

For our example, we'll set the WEP Key Length to 40.

```
AT-TQ2403# set interface wlan0 wep-key-length 40
```

4. Set the Key Type

Valid values for Key Type are ASCII or Hex. The following commands set the Key Type.

Feature or Setting	CLI Command
To set the Key Type to ASCII:	set interface wlan0 wep-key-ascii yes
To set the Key Type to Hex:	set interface wlan0 wep-key-ascii no

For our example, we'll set the Key Type to ASCII:

```
AT-TQ2403# set interface wlan0 wep-key-ascii yes
```

5. Set the WEP Keys

Note: The number of characters required for each WEP key depends on how you set Key Length and Key Type:

- If Key Length is 40 bits and the Key Type is "ASCII", then each WEP key is 5 characters long.
- If Key Length is 40 bits and Key Type is "Hex", then each WEP key must is 10 characters long.
- If Key Length is 104 bits and Key Type is "ASCII", then each WEP Key must be 13 characters long.
- If Key Length is 104 bits and Key Type is "Hex", then each WEP Key must be 26 characters long.

Although the CLI will allow you to enter WEP keys of any number of characters, you must use the correct number of characters for each key to ensure a valid security configuration.

```
AT-TQ2403# set interface wlan0 wep-key-1 abcde
AT-TQ2403# set interface wlan0 wep-key-2 fghij
AT-TQ2403# set interface wlan0 wep-key-3 klmno
AT-TQ2403# set interface wlan0 wep-key-4
```

6. Set the Authentication Algorithm

The options for the authentication algorithm are Open System, Shared Key or Both:

Feature or Setting	CLI Command
To set Authentication Algorithm to **Open System**:	set bss wlan0bssInternal open-system-authentication on set bss wlan0bssInternal shared-key-authentication off
To set Authentication Algorithm to **Shared Key**:	set bss wlan0bssInternal open-system-authentication off set bss wlan0bssInternal shared-key-authentication on

Feature or Setting	CLI Command
To set Authentication Algorithm to **Both**:	set bss wlan0bssInternal open-system-authentication on set bss wlan0bssInternal shared-key-authentication on

For this example, we'll set the authentication algorithm to Shared Key:

```
AT-TQ2403# set bss wlan0bssInternal shared-key-authentication on
AT-TQ2403# set bss wlan0bssInternal open-system-authentication off
```

7. Get Current Security Settings After Re-Configuring to Static WEP Security Mode

Now we can use the "get" command again to view the updated security configuration and see the results of our new settings.

The following command gets the security mode in use on the Internal network:

```
AT-TQ2403# get interface wlan0 security
static-wep
```

The following command gets details on how the internal network is configured, including details on Security.

```
AT-TQ2403# get bss wlan0bssInternal detail
Property                          Value
--------------------------------------------------------------------------------
status                            up
description                       Internal
radio                             wlan0
beacon-interface                  wlan0
mac                               00:01:02:03:02:00
dtim-period                       2
max-stations                      2007
ignore-broadcast-ssid             off
mac-acl-mode                      deny-list
mac-acl-name                      default
radius-accounting                 off
radius-ip                         127.0.0.1
radius-key                        secret
radius-port                       1812
radius-accounting-port            1813
vlan-tagged-interface             br0
open-system-authentication        off
shared-key-authentication         on
wpa-allow-non-wpa-stations        off
wpa-cipher-tkip                   on
wpa-cipher-ccmp                   off
wpa-allowed                       on
wpa2-allowed                      on
rsn-preauthentication             off
```

The following command gets details on the interface and shows the WEP Key settings, specifically.

```
AT-TQ2403# get interface wlan0 detail
Property                          Value
--------------------------------------------------------------------------------
type                              service-set
```

status	up
description	Wireless - Internal
mac	00:01:02:03:02:00
ip	0.0.0.0
mask	
static-ip	0.0.0.0
static-mask	
rx-bytes	0
rx-packets	0
rx-errors	0
rx-drop	0
rx-fifo	0
rx-frame	0
rx-compressed	0
rx-multicast	0
tx-bytes	0
tx-packets	0
tx-errors	0
tx-drop	0
tx-fifo	0
tx-colls	0
tx-carrier	0
tx-compressed	0
stp	
fd	
hello	
priority	
port-isolation	
ssid	allied
bss	wlan0bssInternal
security	static-wep
wpa-personal-key	
wep-key-ascii	yes
wep-key-length	40
wep-default-key	4
wep-key-1	abcde
wep-key-2	fghij
wep-key-3	klmno
wep-key-4	
wep-key-mapping-length	10000
multicast-received-frame-count	11855
vlan-interface	
vlan-id	
radio	
remote-mac	
wep-key	
wds-ssid	
wds-security-policy	
wds-wpa-psk-key	

Set Security to IEEE 802.1x

1. Set the Security Mode
2. Set the Authentication Server
3. Set the RADIUS Key (For External RADIUS Server Only)
4. Enable RADIUS Accounting (External RADIUS Server Only)

5. Get Current Security Settings After Re-Configuring to IEEE 802.1x Security Mode

1. Set the Security Mode

AT-TQ2403# set interface wlan0 security dot1x

2. Set the Authentication Server

You can use the built-in authentication server on the access point or an external RADIUS server.

Note: To use the built-in authentication server, set the RADIUS IP address to that used by the built-in server (127.0.0.1) and turn RADIUS accounting off (because it is not supported by the built-in server)

Feature or Setting	CLI Command
To set the AP to use the **Built-in** Authentication Server:	set bss wlan0bssInternal radius-ip 127.0.0.1
To set the AP to use an **External** RADIUS Server:	set bss wlan0bssInternal radius-ip RADIUS_IP_Address where *RADIUS_IP_Address* is the IP address of an external RADIUS server.

For this example we'll set it to use the built-in server:

AT-TQ2403# set bss wlan0bssInternal radius-ip 127.0.0.1

3. Set the RADIUS Key (For External RADIUS Server Only)

If you use an external RADIUS server, you must provide the RADIUS key. (If you use the built-in authentication server the RADIUS key is automatically provided.)

This command sets the RADIUS key to secret for an external RADIUS server.

AT-TQ2403# set bss wlan0bssInternal radius-key secret

4. Enable RADIUS Accounting (External RADIUS Server Only)

You can enable RADIUS Accounting if you want to track and measure the resources a particular user has consumed such system time, amount of data transmitted and received, and so on.

Note: RADIUS accounting is not supported by the built-in server, so if you are using the built-in server make sure that RADIUS accounting is off.

Feature or Setting	CLI Command
To enable RADIUS accounting:	set bss wlan0bssInternal radius-accounting on
To disable RADIUS accounting:	set bss wlan0bssInternal radius-accounting off

For our example, we'll disable RADIUS accounting since we're using the built-in server:

```
AT-TQ2403# set bss wlan0bssInternal radius-accounting off
```

5. Get Current Security Settings After Re-Configuring to IEEE 802.1x Security Mode

Now we can use the "get" command again to view the updated security configuration and see the results of our new settings.

The following command gets the security mode in use on the Internal network:

```
AT-TQ2403# get interface wlan0 security
dot1x
```

The following command gets details on how the internal BSS is configured, including details on Security.

```
AT-TQ2403# get bss wlan0bssInternal detail
Property                          Value
--------------------------------------------------------------------------------
status                            up
description                       Internal
radio                             wlan0
beacon-interface                  wlan0
mac                               00:01:02:03:02:00
dtim-period                       2
max-stations                      2007
ignore-broadcast-ssid             off
mac-acl-mode                      deny-list
mac-acl-name                      default
radius-accounting                 off
radius-ip                         127.0.0.1
radius-key                        secret
radius-port                       1812
radius-accounting-port            1813
vlan-tagged-interface             br0
open-system-authentication        on
shared-key-authentication         off
wpa-allow-non-wpa-stations        off
wpa-cipher-tkip                   on
wpa-cipher-ccmp                   off
wpa-allowed                       on
wpa2-allowed                      on
rsn-preauthentication             off
```

Set Security to WPA/WPA2 Personal (PSK)

1. Set the Security Mode
2. Set the WPA Versions
3. Set the Cipher Suites
4. Set the Pre-shared Key
5. Get Current Security Settings After Re-Configuring to WPA/WPA2 Personal (PSK)

1. Set the Security Mode

```
AT-TQ2403# set interface wlan0 security wpa-personal
```

2. Set the WPA Versions

Select the WPA version based on what types of client stations you want to support.

Feature or Setting	CLI Command
To support WPA clients: WPA: If all client stations on the network support the original WPA but none support the newer WPA2, then use WPA.	set bss wlan0bssInternal wpa-allowed on set bss wlan0bssInternal wpa2-allowed off
To support WPA2 clients: WPA2: If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard.	set bss wlan0bssInternal wpa-allowed off set bss wlan0bssInternal wpa2-allowed on
To support both WPA and WPA2 clients: Both: If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select "Both". This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.	set bss wlan0bssInternal wpa-allowed on set bss wlan0bssInternal wpa2-allowed on

For this example, we'll set the access point to support Both WPA and WPA2 client stations:

```
AT-TQ2403# set bss wlan0bssInternal wpa-allowed on
AT-TQ2403# set bss wlan0bssInternal wpa2-allowed on
```

3. Set the Cipher Suites

Set the cipher suite you want to use. The options are:

Feature or Setting	CLI Command
To set the cipher suite to TKIP only: TKIP: Temporal Key Integrity Protocol (TKIP), which is the default.	set bss wlan0bssInternal wpa-cipher-tkip on set bss wlan0bssInternal wpa-cipher-ccmp off

Feature or Setting	CLI Command
To set the cipher suite to CCMP (AES) only: CCMP (AES) - Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES).	set bss wlan0bssInternal wpa-cipher-tkip off set bss wlan0bssInternal wpa-cipher-ccmp on
To set the cipher suite to Both: Both - When the authentication algorithm is set to "Both", both TKIP and AES clients can associate with the access point. WPA clients must have either a valid TKIP key or a valid CCMP (AES) key to be able to associate with the AP.	set bss wlan0bssInternal wpa-cipher-tkip on set bss wlan0bssInternal wpa-cipher-ccmp on

In this example, we'll set the cipher suite to **Both**:

```
AT-TQ2403# set bss wlan0bssInternal wpa-cipher-tkip on
AT-TQ2403# set bss wlan0bssInternal wpa-cipher-ccmp on
```

4. Set the Pre-shared Key

The Pre-shared Key is the shared secret key for WPA-PSK. Enter a string of at least 8 characters to a maximum of 63 characters. Following are two examples; the first sets the key to "SeCret !", the second sets the key to "KeepSecret".

Ex1.

```
AT-TQ2403# set interface wlan0 wpa-personal-key “SeCret !”
```

Ex2.

```
AT-TQ2403# set interface wlan0 wpa-personal-key “KeepSecre”
```

Note: Shared secret keys can include spaces and special characters if the key is placed inside quotation marks as in the first example above. If the key is a string of characters with no spaces or special characters in it, the quotation marks are not necessary as in the second example above.

5. Get Current Security Settings After Re-Configuring to WPA/WPA2 Personal (PSK)

Now we can use the "get" command again to view the updated security configuration and see the results of our new settings.

The following command gets the security mode in use on the Internal network:

```
AT-TQ2403# get interface wlan0 security
```

wpa-personal

The following command gets details on how the internal network is configured, including details on Security.

```
AT-TQ2403# get bss wlan0bssInternal detail
Property                          Value
--------------------------------------------------------------------------------
status                            up
description                       Internal
radio                             wlan0
beacon-interface                  wlan0
mac                               00:01:02:03:02:00
dtim-period                       2
max-stations                      2007
ignore-broadcast-ssid             off
mac-acl-mode                      deny-list
mac-acl-name                      default
radius-accounting                 off
radius-ip                         127.0.0.1
radius-key                        secret
radius-port                       1812
radius-accounting-port            1813
vlan-tagged-interface             br0
open-system-authentication        on
shared-key-authentication         off
wpa-allow-non-wpa-stations        off
wpa-cipher-tkip                   on
wpa-cipher-ccmp                   on
wpa-allowed                       on
wpa2-allowed                      on
rsn-preauthentication             off
```

Set Security to WPA/WPA2 Enterprise (RADIUS)

1. Set the Security Mode
2. Set the WPA Versions
3. Enable Pre-Authentication
4. Set the Cipher Suites
5. Set the Authentication Server
6. Set the RADIUS Key (For External RADIUS Server Only)
7. Enable RADIUS Accounting (External RADIUS Server Only)
8. Allow Non-WPA Clients
9. Get Current Security Settings After Re-Configuring to WPA/WPA2 Enterprise (RADIUS)

1. Set the Security Mode

```
AT-TQ2403# set interface wlan0 security wpa-enterprise
```

2. Set the WPA Versions

Select the WPA version based on what types of client stations you want to support.

Feature or Setting	CLI Command
To support WPA clients: WPA: If all client stations on the network support the original WPA but none support the newer WPA2, then use WPA.	set bss wlan0bssInternal wpa-allowed on set bss wlan0bssInternal wpa2-allowed off

Feature or Setting	CLI Command
To support WPA2 clients: WPA2: If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard.	set bss wlan0bssInternal wpa-allowed off set bss wlan0bssInternal wpa2-allowed on
To support both WPA and WPA2 clients: Both: If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select "Both". This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.	set bss wlan0bssInternal wpa-allowed on set bss wlan0bssInternal wpa2-allowed on

For this example, we'll set the access point to support WPA client stations only:

```
AT-TQ2403# set bss wlan0bssInternal wpa-allowed on
AT-TQ2403# set bss wlan0bssInternal wpa2-allowed off
```

3. Enable Pre-Authentication

If you set WPA versions to "WPA2" or "Both", you can enable pre-authentication for WPA2 clients.

Feature or Setting	CLI Command
To enable pre-authentication for WPA2 clients: Enable pre-authentication if you want WPA2 wireless clients to send pre-authentication packet. The pre-authentication information will be relayed from the access point the client is currently using to the target access point. Enabling this feature can help speed up authentication for roaming clients who connect to multiple access points.	set bss wlan0bssInternal rsn-preauthentication on
To disable pre-authentication for WPA2 clients:	set bss wlan0bssInternal rsn-preauthentication off

This option does not apply if you set the WPA Version to support "WPA" clients only because the original

WPA does not support this pre-authentication

For our example, we'll disable pre-authentication.

```
AT-TQ2403# set bss wlan0bssInternal rsn-preauthentication off
```

4. Set the Cipher Suites

Set the cipher suite you want to use. The options are:

Feature or Setting	CLI Command
To set the cipher suite to TKIP only: TKIP: Temporal Key Integrity Protocol (TKIP), which is the default.	set bss wlan0bssInternal wpa-cipher-tkip on set bss wlan0bssInternal wpa-cipher-ccmp off
To set the cipher suite to CCMP (AES) only: CCMP (AES) - Counter mode/CBC- MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES).	set bss wlan0bssInternal wpa-cipher-tkip off set bss wlan0bssInternal wpa-cipher-ccmp on

To set the cipher suite to Both: Both - When the authentication algorithm is set to "Both", both TKIP and AES clients can associate with the access point. WPA clients must have either a valid TKIP key or a valid CCMP (AES) key to be able to associate with the AP.	set bss wlan0bssInternal wpa-cipher-tkip on set bss wlan0bssInternal wpa-cipher-ccmp on

In this example, we'll set the cipher suite to TKIP Only:

```
AT-TQ2403# set bss wlan0bssInternal wpa-cipher-tkip on
AT-TQ2403# set bss wlan0bssInternal wpa-cipher-ccmp off
```

5. Set the Authentication Server

You can use the built-in authentication server on the access point or an external RADIUS server.

Note: To use the built-in authentication server, set the RADIUS IP address to that used by the built-in server (127.0.0.1) and turn RADIUS accounting off (because it is not supported by the built-in server)

Feature or Setting	CLI Command
To set the AP to use the Built-in Authentication Server:	set bss wlan0bssInternal radius-ip 127.0.0.1

Feature or Setting	CLI Command
To set the AP to use an External RADIUS Server:	set bss wlan0bssInternal radius-ip *RADIUS_IP_Address* where *RADIUS_IP_Address* is the IP address of an external RADIUS server.

For this example, we'll use an external RADIUS server with an IP address of 142.77.1.1:

```
AT-TQ2403# set bss wlan0bssInternal radius-ip 142.77.1.1
```

6. Set the RADIUS Key (For External RADIUS Server Only)

If you use an external RADIUS server, you must provide the RADIUS key. (If you use the built-in authentication server the RADIUS key is automatically provided.)

This command sets the RADIUS key to KeepSecret for an external RADIUS server.

```
AT-TQ2403# set bss wlan0bssInternal radius-key KeepSecret
```

7. Enable RADIUS Accounting (External RADIUS Server Only)

You can enable RADIUS Accounting if you want to track and measure the resources a particular user has consumed such system time, amount of data transmitted and received, and so on.

Note: RADIUS accounting is not supported by the built-in server, so if you are using the built-in server make sure that RADIUS accounting is off.

Feature or Setting	CLI Command
To enable RADIUS accounting:	set bss wlan0bssInternal radius-accounting on
To disable RADIUS accounting:	set bss wlan0bssInternal radius-accounting off

For our example, we'll enable RADIUS accounting for our external RADIUS server:

```
AT-TQ2403# set bss wlan0bssInternal radius-accounting on
```

8. Allow Non-WPA Clients

You can let non-WPA (802.11), un-authenticated client stations use this access point by setting the "wpa- allowed" option to "on".

Feature or Setting	CLI Command
To allow non-WPA clients:	set bss wlan0bssInternal wpa-allowed on
To disallow non WPA clients:	set bss wlan0bssInternal wpa2-allowed off

For our example, we'll allow non-WPA clients:

```
AT-TQ2403# set bss wlan0bssInternal wpa-allow-non-wpa-stations on
```

9. Get Current Security Settings After Re-Configuring to WPA/WPA2 Enterprise (RADIUS)

Now we can use the "get" command again to view the updated security configuration and see the results of our new settings.

The following command gets the security mode in use on the Internal network:

```
AT-TQ2403# get interface wlan0 security
wpa-enterprise
```

The following command gets details on how the internal network is configured, including details on security.

```
AT-TQ2403# get bss wlan0bssInternal detai
Property                        Value
------------------------------------------------------------------
status                          up
description                     Internal
radio                           wlan0
beacon-interface                wlan0
mac                             00:01:02:03:02:00
dtim-period                     2
max-stations                    2007
ignore-broadcast-ssid           off
mac-acl-mode                    deny-list
```

mac-acl-name	default
radius-accounting	on
radius-ip	142.77.1.1
radius-key	KeepSecret
radius-port	1812
radius-accounting-port	1813
vlan-tagged-interface	br0
open-system-authentication	on
shared-key-authentication	off
wpa-allow-non-wpa-stations	on
wpa-cipher-tkip	on
wpa-cipher-ccmp	off
wpa-allowed	on
wpa2-allowed	off
rsn-preauthentication	off

Radio Settings

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

This table shows a quick view of Radio Settings commands and links to detailed examples.

Feature or Setting	CLI Command
Get Radio Settings	get radio get radio wlan0 get radio wlan0 detail
Get IEEE 802.11 Radio Mode	get radio wlan0 mode
Get Radio Channel	get radio wlan0 channel
Get Basic Radio Settings	get radio wlan0
Get All Radio Settings	get radio wlan0 detail
Get Supported Rate Set	get supported-rate
Get Basic Rate Set	get basic-rate
Configure Radio Settings	See detailed examples in: "1. Turn the Radio On or Off" "2. Set the Radio Mode" "3. Enable or Disable Super AG" "4. Set the Channel Policy" "5. Set the Radio Channel" "6. Configure Basic and Supported Rate Sets" "7. Set the Beacon Interval" "8. Set the DTIM Period" "9. Set the Fragmentation Threshold" "10. Set the RTS Threshold"

Get IEEE 802.11 Radio Mode

To get the current setting for radio Mode:

```
AT-TQ2403# get radio wlan0 mode
a
```

(The radio in our example is using IEEE 802.11a mode.)

Get Radio Channel

To get the current setting for radio Channel:

```
AT-TQ2403# get radio wlan0 channel
36
```

(The radio in this example is on Channel 36.)

Get Basic Radio Settings

To get basic current Radio settings:

```
AT-TQ2403# get radio wlan0
Property            Value
------------------------------------------------------
status              up
mac                 00:01:02:03:02:00
channel-policy      static
mode                a
static-channel      36
channel             36
tx-rx-status        up
```

Get All Radio Settings

To get all current Radio settings: get radio wlan0 detail

```
AT-TQ2403# get radio wlan0 detail
Property                                Value
-------------------------------------------------------------------------------------------
status                                  up
description                             Radio 1 - IEEE 802.11a
mac                                     00:01:02:03:02:00
max-bss                                 16
channel-policy                          static
mode                                    a
dot11h                                  on
radar-detection                         on
block-time                              30
quiet-duration                          0
quiet-period                            0
tx-mitigation                           3
static-channel                          36
channel                                 36
tx-power                                100
tx-rx-status                            up
beacon-interval                         100
rts-threshold                           2347
fragmentation-threshold                 2346
super-ag                                no
atheros-xr                              no
load-balance-disassociation-utilization 0
load-balance-disassociation-stations    0
load-balance-no-association-utilization 0
ap-detection                            off
station-isolation                       off
frequency                               5180
wme                                     off
```

```
rate-limit-enable                off
rate-limit                       50
rate-limit-burst                 75
```

Get Supported Rate Set

The Supported Rate Set is what the access point supports. The AP will automatically choose the most efficient rate based on factors like error rates and distance of client stations from the AP. For a list the recommended default supported rates per radio mode, see "2. Set the Radio Mode".

```
AT-TQ2403# get supported-rate
name   rate
-----------
wlan1  54
wlan1  48
wlan1  36
wlan1  24
wlan1  18
wlan1  12
wlan1  11
wlan1  9
wlan1  6
wlan1  5.5
wlan1  2
wlan1  1
wlan0  54
wlan0  48
wlan0  36
wlan0  24
wlan0  18
wlan0  12
wlan0  9
wlan0  6
```

Get Basic Rate Set

The Basic Rate Set is what the access point will advertise to the network for the purposes of setting up communication with other APs and client stations on the network. It is generally more efficient to have an AP broadcast a subset of its supported rate sets. For a list the recommended default basic rates per radio mode, see "2. Set the Radio Mode".

```
AT-TQ2403# get basic-rate
name   rate
----------------------
wlan1  11
wlan1  5.5
wlan1  2
wlan1  1
wlan0  24
wlan0  12
wlan0  6
```

Configure Radio Settings

Note: To get a list of all properties you can set on the AP radio, type the following at the CLI prompt:

set radio wlan0 [Space] [Tab] [Tab]

1. Turn the Radio On or Off
2. Set the Radio Mode
3. Enable or Disable Super AG
4. Set the Channel Policy
5. Set the Radio Channel
6. Configure Basic and Supported Rate Sets
7. Set the Beacon Interval
8. Set the DTIM Period
9. Set the Fragmentation Threshold
10. Set the RTS Threshold

1. Turn the Radio On or Off

Feature or Setting	CLI Command
To turn the radio on:	set radio wlan0 status on
To turn the radio off:	set radio wlan0 status off

2. Set the Radio Mode

Valid values depend on the capabilities of the radio. Possible values and how you would use the CLI to set each one are shown below. (For information about Atheros Turbo modes see 802.11a Turbo in Glossary.)

Feature or Setting	CLI Command
IEEE 802.11b	set radio wlan0 mode b
IEEE 802.11g	set radio wlan0 mode g
IEEE 802.11a	set radio wlan0 mode a
Atheros Turbo 5 GHz	set radio wlan0 mode turbo-a
Atheros Dynamic Turbo 5 GHz	set radio wlan0 mode dynamic-turbo-a

Feature or Setting	CLI Command
Atheros Turbo 2.4 GHz	set radio wlan0 mode turbo-g
Atheros Dynamic Turbo 2.4 GHz	set radio wlan0 mode dynamic-turbo-g

The following command sets the Wireless Mode to IEEE 802.11g:

```
AT-TQ2403# set radio wlan0 mode g
```

When you change the radio mode, typically you must change the basic and supported rates to match the mode. For a mapping of radio modes to basic and supported rates, see the table for this in step 6. Configure Basic and Supported Rate Sets.

3. Enable or Disable Super AG

Enabling Super AG provides better performance by increasing radio throughput for a radio mode (IEEE

802.11b, g, a, and so on). However, if Super AG is enabled, the access point transmissions will consume more bandwidth.

Use the following command to determine whether Super AG is enabled on a particular radio.

```
AT-TQ2403# get radio wlan0 super-ag
no
```

The output in the previous example tells us that Super AG hasn't been enabled on this radio. Suppose you want to enable Super AG on this radio. Use the following CLI command to enable Super AG:

```
AT-TQ2403# set radio wlan0 super-ag yes
```

If you want to disable Super AG on a radio, use the following command:

```
AT-TQ2403# set radio wlan0 super-ag no
```

4. Set the Channel Policy

You can set the channel policy to either "static" or "best":

- Setting the channel policy to "static" means that the setting for "static-channel" will apply. (See step 5. Set the Radio Channel below.)

```
AT-TQ2403# set radio wlan0 channel-policy static
```

- Setting the channel policy to "best" means the access point will automatically choose the best channel (one which avoids interference from other overlapping channels on devices in the vicinity). When channel-policy is set to "best", the setting for static-channel does not apply.

```
AT-TQ2403# set radio wlan0 channel-policy best
```

5. Set the Radio Channel

The following command sets the Channel to 6:

```
AT-TQ2403# set radio wlan0 static-channel 6
```

Note that this setting for a "static-channel" only takes effect if the Channel Policy (channel-policy) is set to static.

The channels available will depend on the radio mode of your access point and the country in which the AP is operating. The following mappings of modes to channel sets assume the AP is operating in the United States (country code is "us"). For more information on setting the channel policy, see "4. Set the Channel Policy".

- For IEEE 802.11b and IEEE 802.11g modes (including b/g radios), the radio can use channels 1 through 11 inclusive.
- For IEEE 802.11a mode, the radio can use channels 36, 40, 44, 48, 52, 56, 60, 64, 149, 153, 157, 161,165.
- For Atheros 5 GHz Turbo or Atheros Dynamic Turbo 5 GHz (IEEE 802.11a turbo), the radio can use a subset of the "a" mode channels: 40, 48, 56, 153, and 161.
- For Atheros 2.4 GHz Turbo or Atheros Dynamic Turbo 2.4 GHz (IEEE 802.11g turbo), the radio can use only one of the "b/g" mode channels: 6.

6. Configure Basic and Supported Rate Sets

The syntax for working with basic and supported rates on the AP is as follows. In the examples below, the Command is either get, add, or remove and "wlan0" is used as the WirelessInterface.

Command basic-rate WirelessInterface rate SomeRate

Feature or Setting	CLI Command
Get current basic rates	get basic-rate
Add a basic rate set	add basic-rate wlan0 rate 48
Remove a basic rate	remove basic-rate wlan0 rate 11
Remove all basic rates	remove basic-rate wlan0
Get current supported rates	get supported-rate wlan0
Add supported rate	add supported-rate wlan0 rate 9
Remove a supported rate	remove supported-rate wlan0 rate 11
Remove all supported rates	remove supported-rate wlan0

Suggested defaults for basic and supported rates for the various radio modes are shown in the table below. Rates are expressed in megabits per second.

Radio Mode	Basic Rates	Supported Rates
a (IEEE 802.11a)	24, 12, 6 megabits per second (Mbps)	54, 48, 36, 24, 18, 12, 9, 6 Mbps
b (IEEE 802.11b)	2, 1 Mbps	11, 5.5, 2, 1 Mbps

Radio Mode	Basic Rates	Supported Rates
g (IEEE 802.11g)	11, 5.5, 2, 1 Mbps	54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps **Note**: Including rates 24, 12, and 6 as Supported Rates for "g" mode will prevent "b" clients from connecting since they do not support these rates, but will allow "g" clients to connect since they are required by the standard to support these rates.
turbo-a (Atheros Turbo 5 GHz)	48, 24, 12 Mbps	108, 96, 72, 48, 36, 24, 18, 12 Mbps
dynamic-turbo-a (Atheros Dynamic Turbo 5GHz / IEEE 802.11a)	24, 12, 6 Mbps	54, 48, 36, 24, 18, 12, 9, 6 Mbps
turbo-g (Atheros Turbo 2.4 GHz / IEEE 802.11g))	48, 24, 12 Mbps	108, 96, 72, 48, 36, 24, 18, 12 Mbps
dynamic-turbo-g (Atheros Dynamic Turbo 2.4 GHz / IEEE 802.11g)	11, 5.5, 2, 1 Mbps	54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps

The following command adds "48" as a basic rate to wlan0 (the internal, wireless interface):

```
AT-TQ2403# add basic-rate wlan0 rate 48
```

To get the basic rates currently configured for this AP:

```
AT-TQ2403# get basic-rate
name   rate
-----------
wlan1  11
wlan1  5.5
wlan1  2
wlan1  1
wlan0  24
wlan0  12
wlan0  6
wlan0  48
```

The following command removes "11" as a basic rate from wlan1 (the internal, wireless interface):

```
AT-TQ2403# remove basic-rate wlan1 rate 11
```

The following command shows that basic rate "11"has been removed from wlan1 and displays the currently configured rates for this AP:

```
AT-TQ2403# get basic-rate
name   rate
-------------------------
wlan1  5.5
wlan1  2
wlan1  1
wlan0  24
wlan0  12
wlan0  6
wlan0  48
```

The following command adds "9" as a supported rate to wlan0 (the internal, wireless interface):

```
AT-TQ2403# add supported-rate wlan0 rate 9
```

To get the supported rates currently configured for this AP (using "wlan0" as the interface for this example):

```
AT-TQ2403# get supported-rate wlan0
rate
----
54
48
36
24
18
12
9
6
```

The following command removes "12" as a supported rate to wlan0:

```
AT-TQ2403# remove supported-rate wlan0 rate 12
```

The following command shows that "12" has been removed as a supported rate to wlan0 and displays the currently configured rates for this AP:

```
AT-TQ2403# get supported-rate wlan0
rate
----
54
48
36
24
18
9
6
```

7. Set the Beacon Interval

The following command sets the beacon interval to 80.

```
AT-TQ2403# set radio wlan0 beacon-interval 80
```

8. Set the DTIM Period

The Delivery Traffic Information Map (DTIM) period indicates how often wireless clients should check to see if they have buffered data on the AP awaiting pickup. The DTIM beacon alerts the clients that

multicast and broadcast packets buffered at the AP will be transmitted immediately after the transmission of this beacon frame. The measurement is in beacon intervals.

Specify a DTIM period within a range of 1 - 255 beacons.

For example, if you set this to "1" clients will check for buffered data on the AP at every beacon. If you set this to "2", clients will check on every other beacon.

The following command sets the DTIM interval to 3.

```
AT-TQ2403# set bss wlan0bssInternal dtim-period 3
```

To get the updated value for DTIM interval after you have changed it:

```
AT-TQ2403# get bss wlan0bssInternal dtim-period
3
```

9. Set the Fragmentation Threshold

You can specify a fragmentation threshold as a number between 256 and 2,346 to set the frame size threshold in bytes. The fragmentation threshold is a way of limiting the size of packets (frames) transmitted over the network. If a packet exceeds the fragmentation threshold set here, the fragmentation function will be activated and the packet will be sent as multiple 802.11 frames. If the packet being transmitted is equal to or less than the threshold, fragmentation will not be used. Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation.

The following command sets the fragmentation threshold to 2000.

```
AT-TQ2403# set radio wlan0 fragmentation-threshold 2000
```

10. Set the RTS Threshold

You can specify an RTS Threshold value between 0 and 2347. The RTS threshold specifies the packet size of a request to send (RTS) transmission. This helps control traffic flow through the access point, especially one with a lot of clients.

The following command sets the RTS threshold at

```
AT-TQ2403# set radio wlan0 rts-threshold 2346
```

MAC Filtering

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

You can control access to AT-TQ2403 Management Software based on Media Access Control (MAC) addresses. Based on how you set the filter, you can allow only client stations with a listed MAC address or prevent access to the stations listed.

1. Specify an Accept or Deny List
2. Add MAC Addresses of Client Stations to the Filtering List
3. Remove a Client Station's MAC Address from the Filtering List

4. Getting Current MAC Filtering Settings:

5. Get the Type of MAC Filtering List Currently Set (Accept or Deny)

6. Get MAC Filtering List

1. Specify an Accept or Deny List

To set up MAC filtering you first need to specify which type of list you want to configure

Feature or Setting	CLI Command
To set up an **Accept** list: (With this type of list, client stations whose MAC addresses are listed will be allowed access to the AP.)	set bss wlan0bssInternal mac-acl-mode accept-list
To set up a **Deny** list: (With this type of list, the AP will prevent access to client stations whose MAC addresses are listed.)	set bss wlan0bssInternal mac-acl-mode deny-list

2. Add MAC Addresses of Client Stations to the Filtering List

To add a MAC address to the list:

```
add mac-acl default mac MAC_Address_Of_Client
```

Where MAC_Address_Of_Client is the MAC address of a wireless client you want to add to the MAC filtering list.

For example, to add 4 new clients to the list with the following MAC addresses:

```
AT-TQ2403# add mac-acl default mac 00:01:02:03:04:05
AT-TQ2403# add mac-acl default mac 00:01:02:03:04:06
AT-TQ2403# add mac-acl default mac 00:01:02:03:04:07
AT-TQ2403# add mac-acl default mac 00:01:02:03:04:08
```

Note: Although each BSS may have a specific mac-acl list, by default all BSSes use the mac-acl list named "default". Changes to the MAC Filtering list in the Web UI will update this list, as well as setting all BSSes to use the same mac- acl-mode.

3. Remove a Client Station's MAC Address from the Filtering List

To remove a MAC address from the list:

```
remove mac-acl default mac MAC_Address_Of_Client
```

Where MAC_Address_Of_Client is the MAC address of a wireless client you want to remove from the MAC filtering list.

For example:

```
AT-TQ2403# remove mac-acl default mac 00:01:02:03:04:04
```

4. Getting Current MAC Filtering Settings

Get the Type of MAC Filtering List Currently Set (Accept or Deny)

The following command shows which type of MAC filtering list is currently configured:

```
AT-TQ2403# get bss wlan0bssInternal mac-acl-mode
deny-list
```

Get MAC Filtering List

The following command shows the clients on the MAC filtering list:

```
AT-TQ2403# get mac-acl
name     mac
--------------------------
default  00:01:02:03:04:05
default  00:01:02:03:04:06
default  00:01:02:03:04:07
default  00:01:02:03:04:08
```

Load Balancing

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

Load balancing parameters affect the distribution of wireless client connections across multiple access points. Using load balancing, you can prevent scenarios where a single access point in your network shows performance degradation because it is handling a disproportionate share of the wireless traffic. (For a detailed conceptual overview of Load Balancing, see "Load Balancing".)

The AP provides default settings for load balancing.

The following command examples reconfigure some load balancing settings and get details on the configuration:

```
AT-TQ2403# set radio wlan0 load-balance-disassociation-station 2
AT-TQ2403# get radio wlan0 load-balance-disassociation-station
2
AT-TQ2403# set radio wlan0 load-balance-disassociation-utilization 25
AT-TQ2403# get radio wlan0 load-balance-disassociation-station
25
AT-TQ2403# set radio wlan0 load-balance-no-association-utilization 50
AT-TQ2403# get radio wlan0 load-balance-no-association-utilization
50
```

Quality of Service

Note: Before configuring this feature from the CLI, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name referenced in a command determines if a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

Quality of Service (QoS) provides you with the ability to specify parameters on multiple queues for increased throughput and better performance of differentiated wireless traffic like Voice-over-IP (VoIP), other types of audio, video, and streaming media as well as traditional IP data over the AT-TQ2403 Management Software.

For a complete conceptual overview of QoS, see "Configuring Quality of Service (QoS)". This table shows a quick view of QOS commands and links to detailed examples.

Feature or Setting	CLI Command
Enable/Disable Wi-Fi Multimedia	set radio wlan0 wme off set radio wlan0 wme on get radio wlan0 wme
About AP and Station EDCA Parameters	See "About AP and Station EDCA Parameters".
Understanding the Queues for AP and Station	See "Understanding the Queues for AP and Station".
Distinguishing between AP and Station	See "Distinguishing between AP and Station Settings in QoS Commands".
Get QoS Settings on the AP	get tx-queue
Get QoS Settings on the Client Station	get wme-queue
Set Arbitration Interframe Spaces (AIFS)	On the AP: set wme-queue wlan0 with queue Queue_Name to aifs AIFS_Value On a client station: set wme-queue wlan0 with queue Queue_Name to aifs AIFS_Value See examples in "Set Arbitration Interframe Spaces (AIFS)".

Feature or Setting	CLI Command
Setting Minimum and Maximum Contention Windows (cwmin, cwmax)	On the AP: set tx-queue wlan0 with queue Queue_Name to cwmin cwmin_Value cwmax cwmax_Value On a client station: set wme-queue wlan0 with queue Queue_Name to cwmin cwmin_Value cwmax cwmax_Value See examples in "Setting Minimum and Maximum Contention Windows (cwmin, cwmax)".
Set the Maximum Burst Length (burst) on the AP	set tx-queue wlan0 with queue Queue_Name to burst burst_Value See examples in "Set the Maximum Burst Length (burst) on the AP".
Set Transmission Opportunity Limit (txop-limit) for WMM client stations	set wme-queue wlan0 with queue Queue_Name to txop-limit txop-limit_Value See examples in "Set Transmission Opportunity Limit (txop-limit) for WMM client stations".

Enable/Disable Wi-Fi Multimedia

By default, Wi-Fi MultiMedia (WMM) is disabled on the access point. With WMM enabled, QoS settings on the AT-TQ2403 Management Software control both downstream traffic flowing from the access point to client station (AP EDCA parameters) and upstream traffic flowing from the station to the access point (station EDCA parameters). Enabling WMM essentially activates station-to-AP QoS control.

Disabling WMM will deactivates QoS control of "station EDCA parameters" on upstream traffic flowing from the station to the access point. With WMM disabled, you can still set downstream AP-to-station QoS parameters but no station-to-AP QoS parameters.

- To disable WMM:

```
AT-TQ2403# set radio wlan0 wme off
AT-TQ2403# get radio wlan0 wme
off
```

- To enable WMM:

```
AT-TQ2403# set radio wlan0 wme on
AT-TQ2403# get radio wlan0 wme
on
```

About AP and Station EDCA Parameters

AP Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the access point to the client station (AP-to-station).

Station Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the client station to the access point (station-to-AP). Keep in mind that station-to-AP parameters apply only when WMM is enabled as described in "Enable/Disable Wi-Fi Multimedia".

Understanding the Queues for AP and Station

The same types of queues are defined for different kinds of data transmitted from AP-to-station and station-to-AP but they are referenced by differently depending on whether you are configuring AP or station parameters.

Data	AP	Station
Voice - High priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue.	data0	vo
Video - High priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue.	data1	vi
Best Effort - Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue.	data2	be
Background - Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).	data3	bk

Distinguishing between AP and Station Settings in QoS Commands

Access Point - To get and set QoS settings on the access point (AP), use "tx-queue" class name in the command.

Station - To get and set QoS settings on the client station, use the "wme-queue" class name in the command.

Get QoS Settings on the AP

To view the current QoS settings and queue names for AP-to-station parameters:

```
AT-TQ2403# get tx-queue
name   queue  aifs  cwmin  cwmax    burst
-------------------------------------------------------------
wlan1  data0  1     3      7        1.5
wlan1  data1  1     7      15       3.0
wlan1  data2  3     15     63       0
wlan1  data3  7     15     1023     0
wlan0  data0  1     3      7        1.5
wlan0  data1  1     7      15       3.0
wlan0  data2  3     15     63       0
wlan0  data3  7     15     1023     0
```

Get QoS Settings on the Client Station

To view the current QoS settings queue names for station-to-AP parameters:

```
AT-TQ2403# get wme-queue
name       queue    aifs       cwmin    cwmax   txop-limit
-------------------------------------------------------------------
wlan1      vo       2          3        7       47
wlan1      vi       2          7        15      94
```

```
wlan1     be      3       15      1023    0
wlan1     bk      7       15      1023    0
wlan0     vo      2       3       7       47
wlan0     vi      2       7       15      94
wlan0     be      3       15      1023    0
wlan0     bk      7       15      1023    0
```

Set Arbitration Interframe Spaces (AIFS)

Arbitration Inter-Frame Spacing (AIFS) specifies a wait time (in milliseconds) for data frames.

Valid values for AIFS are 1-255.

Set AIFS on the AP

To set AIFS on AP-to-station traffic:

```
set tx-queue wlan0 with queue Queue_Name to aifs AIFS_Value
```

Where Queue_Name is the queue on the AP to which you want the setting to apply and AIFS_Value is the wait time value you want to specify for AIFS.

For example, this command sets the AIFS wait time on the AP Voice queue (data0) to 13 milliseconds.

```
AT-TQ2403# set tx-queue wlan0 with queue data0 to aifs 13
```

View the results of this configuration update (bold in the command output highlights the modified value):

```
AT-TQ2403# get tx-queue
name      queue   aifs      cwmin   cwmax   burst
-------------------------------------------------------------------------
wlan1     data0   1         3       7       1.5
wlan1     data1   1         7       15      3.0
wlan1     data2   3         15      63      0
wlan1     data3   7         15      1023    0
wlan0     data0   13        3       7       1.5
wlan0     data1   1         7       15      3.0
wlan0     data2   3         15      63      0
wlan0     data3   7         15      1023    0
```

Set AIFS on the Client Station

To set the AIFS on station-to-AP traffic:

```
set wme-queue wlan0 with queue Queue_Name to aifs AIFS_Value
```

Where Queue_Name is the queue on the station to which you want the setting to apply and AIFS_Value is the wait time value you want to specify for AIFS.

For example, this command sets the AIFS wait time on the station Voice queue (vo) to 14 milliseconds.

```
AT-TQ2403# set wme-queue wlan0 with queue vo to aifs 14
```

View the results of this configuration update (bold in the command output highlights the modified value):

```
AT-TQ2403# get wme-queue
name      queue   aifs      cwmin   cwmax   txop-limit
-------------------------------------------------------------------------
wlan1     vo      2         3       7       47
```

wlan1	vi	2	7	15	94
wlan1	be	3	15	1023	0
wlan1	bk	7	15	1023	0
wlan0	vo	14	3	7	47
wlan0	vi	2	7	15	94
wlan0	be	3	15	1023	0
wlan0	bk	7	15	1023	0

Setting Minimum and Maximum Contention Windows (cwmin, cwmax)

The Minimum Contention Window (cwmin) sets the upper limit (in milliseconds) of the range from which the initial random backoff wait time is determined. For more details, see "Random Backoff and Minimum / Maximum Contention Windows" and the more detailed property description for this value in that topic.)

Valid values for the "cwmin" are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1024. The value for "cwmin" must be lower than the value for "cwmax".

The Maximum Contention Window (cwmax) sets the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. For more details, see "Random Backoff and Minimum / Maximum Contention Windows" and the more detailed property description for this value in that topic.)

Valid values for the "cwmax" are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1024. The value for "cwmax" must be higher than the value for "cwmin".

Set cwmin and cwmax on the AP

To set the Minimum and Maximum Contention Windows (cwmin, cwmax) on AP-to-station traffic:

```
set tx-queue wlan0 with queue Queue_Name to cwmin cwmin_Value cwmax cwmax_Value
```

Where Queue_Name is the queue on the AP to which you want the setting to apply and cwmin_Value and cwmax_Value are the values (in milliseconds) you want to specify for contention back-off windows.

For example, this command sets the AP Video queue (data1) cwmin value to 15 and cwmax value to 31.

```
AT-TQ2403# set tx-queue wlan0 with queue data1 cwmin 15 cwmax 31
```

View the results of this configuration update (bold in the command output highlights the modified values):

```
AT-TQ2403# get tx-queue
name       queue    aifs       cwmin    cwmax   burst
-------------------------------------------------------------------------
wlan1      data0    1          3        7       1.5
wlan1      data1    1          7        15      3.0
wlan1      data2    3          15       63      0
wlan1      data3    7          15       1023    0
wlan0      data0    13         3        7       1.5
wlan0      data1    1          15       31      3.0
wlan0      data2    3          15       63      0
wlan0      data3    7          15       1023    0
```

Set cwmin and cwmax on the Station

To set the Minimum and Maximum Contention Windows (cwmin, cwmax) on station-to-AP traffic:

```
set wme-queue wlan0 with queue Queue_Name to cwmin cwmin_Value cwmax
```

cwmax_Value

Where Queue_Name is the queue on the station to which you want the setting to apply and cwmin_Value and cwmax_Value are the values (in milliseconds) you want to specify for contention back-off windows.

For example, this command sets the client station Video queue (vi) cwmin value to 15 and cwmax value to 31.

```
AT-TQ2403# set wme-queue wlan0 with queue vi cwmin 7 cwmax 15
```

View the results of this configuration update (bold in the command output highlights the modified values):

```
AT-TQ2403# get wme-queue
name      queue   aifs      cwmin   cwmax   txop-limit
-----------------------------------------------------------------
wlan1     vo      2         3       7       47
wlan1     vi      2         7       15      94
wlan1     be      3         15      1023    0
wlan1     bk      7         15      1023    0
wlan0     vo      14        3       7       47
wlan0     vi      2         7       15      94
wlan0     be      3         15      1023    0
wlan0     bk      7         15      1023    0
```

Set the Maximum Burst Length (burst) on the AP

The Maximum Burst Length (burst) specifies (in milliseconds) the Maximum Burst Length allowed for packet bursts on the wireless network. A packet burst is a collection of multiple frames transmitted without header information. The burst applies only to the access point (AP-to-station traffic). Valid values for maximum burst length are 0.0 through 999.9.

To set the maximum burst length on AP-to-station traffic:

```
set tx-queue wlan0 with queue Queue_Name to burst burst_Value
```

Where Queue_Name is the queue on the AP to which you want the setting to apply and burst_Value is the wait time value you want to specify for maximum burst length.

For example, this command sets the maximum packet burst length on the AP Best Effort queue (data2) to 0.5.

```
AT-TQ2403# set tx-queue wlan0 with queue data2 to burst 0.5
```

View the results of this configuration update (bold in the command output highlights the modified value):

```
AT-TQ2403# get tx-queue
name      queue   aifs      cwmin   cwmax   burst
-----------------------------------------------------------------
wlan1     data0   1         3       7       1.5
wlan1     data1   1         7       15      3.0
wlan1     data2   3         15      63      0
wlan1     data3   7         15      1023    0
wlan0     data0   13        3       7       1.5
wlan0     data1   1         15      31      3.0
wlan0     data2   3         15      63      0.5
wlan0     data3   7         15      1023    0
```

Set Transmission Opportunity Limit (txop-limit) for WMM client stations

The Transmission Opportunity Limit (txop-limit) specifies an interval of time (in milliseconds) when a WMM client station has the right to initiate transmissions on the wireless network. The txop-limit applies only to the client stations (station-to-AP traffic).

To set the txop-limit on station-to-AP traffic:

```
set wme-queue wlan0 with queue Queue_Name to txop-limit txop-limit_Value
```

Where Queue_Name is the queue on the station to which you want the setting to apply and txop-limit_Value is the value you want to specify for the txop-limit.

For example, this command sets the txop-limit on the station Voice queue (vo) to 49.

```
AT-TQ2403# set wme-queue wlan0 with queue vo to txop-limit 49
```

View the results of this configuration update (bold in the command output highlights the modified value):

```
AT-TQ2403# get wme-queue
name      queue   aifs      cwmin    cwmax   txop-limit
-------------------------------------------------------------------------
wlan1     vo      2         3        7       47
wlan1     vi      2         7        15      94
wlan1     be      3         15       1023    0
wlan1     bk      7         15       1023    0
wlan0     vo      14        3        7       49
wlan0     vi      2         7        15      94
wlan0     be      3         15       1023    0
wlan0     bk      7         15       1023    0
```

Wireless Distribution System (WDS)

Note: Before configuring this feature, make sure you are familiar with the names of the interfaces as described in "Understanding Interfaces as Presented in the CLI". The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal or Guest network, or (on a dual-radio AP) to radio "one" or radio "two".

This table shows a quick view of WDS commands and links to detailed examples.

Feature or Setting	CLI Command
Getting Details on a WDS Configuration	get interface wlan0wds0 detail

Configuring a WDS Link

To set up a Wireless Distribution System (WDS) link between two wireless networks:

1. Enable the WDS interface (wlan0wds0) on the current access point:

```
AT-TQ2403# set interface wlan0wds0 status up
AT-TQ2403# set interface wlan0wds0 radio wlan0
```

2. Provide the MAC address of the remote access point to which you want to link:

```
AT-TQ2403# set interface wlan0wds0 remote-mac MAC_Address_Of_Remote_AP
```

For example:

```
AT-TQ2403# set interface wlan0wds0 remote-mac 00:E0:B8:76:1B:14
```

Setting Security for a WDS link to WPA-Personal

The WPA (PSK) security setting can only be set on the WDS link if you have set security on both APs to either WPA Personal or WPA Enterprise.

1. Bring up the WLAN0 interface and set its security to WPA-Personal:

```
AT-TQ2403# set interface wlan0 ssid "myssid"
AT-TQ2403# set interface wlan0 security wpa-personal
AT-TQ2403# set interface wlan0 wpa-personal-key 12345678
```

2. After setting the security on the access point, you also want to apply security settings to the WDS link:

```
AT-TQ2403# set interface wlan0wds0 status up remote-mac 00:80:98:78:18:50
AT-TQ2403# set interface wlan0wds0 wds-ssid wds-test
AT-TQ2403# set interface wlan0wds0 wds-wpa-psk-key 12345678
AT-TQ2403# set interface wlan0wds0 wds-security-policy wpa-personal
```

Getting Details on a WDS Configuration

Verify the configuration of the WDS link you just configured by getting details on the WDS interface:

```
AT-TQ2403# get interface wlan0wds0 detail
Property                Value
------------------------------------------------------------------------------
type                    wds
status                  up
description             Wireless Distribution System - Link 1
mac                     00:01:02:03:02:00
ip
mask
static-ip
static-mask
rx-bytes                0
rx-packets              0
rx-errors               0
rx-drop                 0
rx-fifo                 0
rx-frame                0
rx-compressed           0
rx-multicast            0
tx-bytes                0
tx-packets              0
tx-errors               0
tx-drop                 0
tx-fifo                 0
tx-colls                0
tx-carrier              0
tx-compressed           0
stp
fd
hello
```

```
priority
port-isolation
ssid
bss
security
wpa-personal-key
wep-key-ascii                   no
wep-key-length                  104
wep-default-key
wep-key-1
ep-key-2
wep-key-3
wep-key-4
wep-key-mapping-length
multicast-received-frame-count
vlan-interface
vlan-id
radio                           wlan0
remote-mac                      00:80:98:78:18:50
wep-key
wds-ssid                        wds-test
wds-security-policy             wpa-personal
wds-wpa-psk-key                 12345678
```

Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) defines a standard for recording, storing, and sharing information about network devices. SNMP facilitates network management, troubleshooting, and maintenance. (For more information, see "Configuring Simple Network Management Protocol (SNMP) on the AP".)

The AT-TQ2403 Management Software can function as an SNMP managed device for seamless integration into network management systems such as HP OpenView.

The following information describes how to use the CLI to start and stop SNMP agents, configure community password, get access to MIBs, and configure SNMP Trap destinations. (Note that this section does not describe how to use SNMP to configure and manage the AP a complete alternative to CLI or Web UI configuration. Full SNMP control to this extent is not yet supported.)

To enable and configure the SNMP service on the access point do the following:

1. Enable/Disable SNMP

```
set snmp status up
set snmp status down
```

Note that SNMP must be enabled (up) in order for the rest of these commands to take effect.

2. Set the read-only community name for permitted GETs

```
set snmp ro-community <name>
```

3. Set the Port number on which the SNMP agent will listen

```
set snmp port <port-number>
```

By default an SNMP agent only listens to requests from port 161. However, you can configure this so the agent listens to requests on another port.

4. Allow/Prohibit SNMP SET Commands

```
set snmp rw-status up
set snmp rw-status down
```

5. Set the read-write community name for permitted SETs

```
set snmp rw-community <name>
```

6. Restrict the source of SNMP requests to only the designated hosts or subnets

```
set snmp source-status up
set snmp source-status down
```

When "source-status" is enabled (up), the AP accepts SNMP only from designated hosts or subnets. When "source-status" is disabled (down), the AP accepts all SNMP requests it receives.

7. Specify hosts or subnets that can make SNMP requests to the AP

Note that this setting is valid only when the "source-status" is enabled (up).

As with community names, this provides a level of security on SNMP settings. The SNMP agent will only accept requests from the hostname or subnet specified here.

Specify the DNS hostname or subnet of the machines that can execute GET and SET requests to the managed devices as follows:

```
set snmp source <hostname_or_subnet>
```

If you need more information on specifying DNS hostnames or address ranges for subnets, see the description of this SNMP setting for the Web UI in “Configuring SNMP Settings”.

Time Protocol

The Network Time Protocol (NTP) is an Internet standard protocol that synchronizes computer clock times on your network. NTP servers transmit Coordinated Universal Time (UTC, also known as Greenwich Mean Time) to their client systems. NTP sends periodic time requests to servers, using the returned time stamp to adjust its clock. The timestamp will be used to indicate the date and time of each event in log messages. See http://www.ntp.org for more general information on NTP.

To enable the Network Time Protocol (NTP) server on the access point do the following:

1. Enable the NTP Server

```
AT-TQ2403# set ntp status up
```

2. Provide the Host Name or Address of an NTP Server

```
set ntp server NTP_Server
```

Where NTP_Server is the host name or IP address of the NTP server you want to use. (We recommend using the host name rather than the IP address, since IP addresses these change more frequently.)

```
AT-TQ2403# set ntp server ntp.alliedtelesis.com
```

3. Synchronize Automatically

If enabled, the device will synchronize time with the NTP server automatically.

```
AT-TQ2403# set ntp auto-sync up
```

4. Interval to Synchronize

If Synchronize Automatically is enabled, the device will synchronize time with the NTP server at each specified interval. This interval is set in minutes.

```
AT-TQ2403# set ntp sync-intv 20
```

5. Time zone

Specify the time zone where the device locates. The time zone determines the local time when the device is synchronizing time with the NTP server.

```
AT-TQ2403# set ntp time-offset 480
```

6. Get Current Time Protocol Settings

```
AT-TQ2403# get ntp detail
Property    Value
--------------------------------
status      up
server      ntp.alliedtelesis.com
auto-sync   up
sync-intv   0
time-offset 480
```

Pre-Config Rogue AP

Pre-config Rogue Configuration notifies you when access points are not in the Access Points list. Access points are filtered by MAC address, a hardware ID number that uniquely identifies each node of a network. A MAC address consists of a string of twelve (12) hexadecimal digits separated by colons, for example FE:DC:BA:09:87:65.

These settings apply to both the internal and guest networks of both radios.

When a MAC address does not match an entry in the Access Points list, then an SNMP trap is sent. SNMP traps enable an agent to notify the management station of significant events by way of an unsolicited SNMP message.

For a single radio with no guest account, a single MAC address is required in the Access Points list. If the guest account is enabled, then both the primary and guest MAC address are required. Likewise, any additional VLANs or radio upgrades may require additional entries in this field.

```
AT-TQ2403# add ap-list mac 00:01:02:03:04:06
AT-TQ2403# get ap-list
00:01:02:03:04:06
AT-TQ2403# remove ap-list mac 00:01:02:03:04:06
```

Reboot the AP

To reboot the access point, simply type "**reboot**" at the command line:

```
AT-TQ2403# reboot
```

Reset the AP to Factory Defaults

If you are experiencing extreme problems with the AT-TQ2403 Management Software and have tried all other troubleshooting measures, you can reset the access point. This will restore factory defaults and clear all settings, including settings such as a new password or wireless settings. You will be prompted to confirm whether you do want to reset the system.

The following command resets the access point from the CLI:

```
AT-TQ2403# factory-reset
Are you sure you want to reset the system to factory defaults <y/n>?
```

Note: Keep in mind that the factory-reset command resets only the access point you are currently administering; not other access points in the cluster.

Upgrade the Firmware

As new versions of the AT-TQ2403 Management Software firmware become available, you can upgrade the firmware on your devices to take advantages of new features and enhancements.

Caution:

Do not upgrade the firmware from a wireless client that is associated with the access point you are upgrading. Doing so will cause the upgrade to fail. Furthermore, all wireless clients will be disassociated and no new associations will be allowed.

If you encounter this scenario, the solution is to use a wired client to gain access to the access point:

- Create a wired Ethernet connection from a PC to the access point.
- Bring up the Administration UI

Repeat the upgrade process using with the wired client.

Note: You must do this for each access point; you cannot upgrade firmware automatically across the cluster.

Keep in mind that a successful firmware upgrade restores the access point configuration to the factory defaults

To determine the firmware version you are currently running on your AP, use the following command:

```
AT-TQ2403# get system version
2.0.0
```

Follow these steps to upgrade to the latest firmware using the CLI:

1. Before you begin the upgrade process, put the valid upgrade file on a web server that is accessible from the AP.

2. Set the upgrade URL from the CLI. This URL should be the URL of the upgrade file on the web server.

   AT-TQ2403# set firmware-upgrade upgrade-url http://10.10.28.249/upgrade.img

3. It is good practice to check the validity of the upgrade file. Validate the file using the following command:

   AT-TQ2403# set firmware-upgrade validate yes
   AT-TQ2403# get firmware-upgrade progress validation success
   validation success

4. If the upgrade file is found to be valid you can start the firmware upgrade.

   AT-TQ2403# set firmware-upgrade start yes

Note: If the firmware upgrade fails, you can use the get firmware-upgrade progress command to determine the progress of the upgrade and where it may have failed.

   If the upgrade was successful the AP will reboot automatically.

5. You can then check the system version of the firmware using the following command:

   AT-TQ2403# get system version
   2.0.1

   If the version is a higher version than you were running before, the firmware upgrade was successful.

Keyboard Shortcuts and Tab Completion Help

The CLI provides keyboard shortcuts to help you navigate the command line and build valid commands, along with "tab completion" hints on available commands that match what you have typed so far. Using the CLI will be easier if you use the tab completion help and learn the keyboard shortcuts.

- Keyboard Shortcuts
- Tab Completion and Help

Keyboard Shortcuts

Action on CLI	Keyboard Shortcut
Move cursor to the beginning of the current line	Ctrl-a
Move cursor to the end of the current line	Ctrl-e
Move cursor back on the current line, one character at a time	Ctrl-b Left Arrow key

Action on CLI	Keyboard Shortcut
Move the cursor forward on the current line, one character at a time	Ctrl-f Right Arrow Key
Start over at a blank command prompt (abandons the input on the current line)	Ctrl-c
Remove one character on the current line.	Ctrl-h
Remove the last word in the current command. (Clears one word at a time from the current command line, always starting with the last word on the line.)	Ctrl-W
Remove characters starting from cursor location to end of the current line. (Clears the current line from the cursor forward.)	Ctrl-k
Remove all characters before the cursor. (Clears the current line from the cursor back to the CLI prompt.)	Ctrl-U
Clear screen but keep current CLI prompt and input in place.	Ctrl-l
Display previous command in history. (Ctrl-p and Ctrl-n let you cycle through a history of all executed commands like Up and Down arrow keys typically do. Up/Down arrow keys also work for this.)	Ctrl-p Up Arrow key
Display next command in history. (Ctrl-p and Ctrl-n let you cycle through a history of all executed commands like Up and Down arrow keys typically do. Up/Down arrow keys also work for this.)	Ctrl-n Down Arrow key
Exit the CLI. (At a blank command prompt, typing Ctrl-d closes the CLI.) (Typing Ctrl-d within command text also removes characters, one at a time, at cursor location like Ctrl-h.)	Ctrl-d

Tab Completion and Help

Help on commands can be requested at the command line interface (CLI) by using the TAB key. (See also "Basic Settings".)

Hitting TAB once will attempt to complete the current command.

If multiple completions exist, a beep will sound and no results will be displayed. Enter TAB again to display all available completions.

- **Example 1:** At a blank command line, hit TAB twice to get a list of all commands.

  AT-TQ2403#

```
add                 Add an instance to the running configuration
factory-reset       Reset the system to factory defaults
get                 Get property values of the running configuration
reboot              Reboot the system
remove              Remove instances in the running configuration
save-running        Save the running configuration
set                 Set property values of the running configuration
```

- **Example 2:** Type "**get** " TAB TAB (including a space after **get**) to see a list of all property options for the **get** command.

```
AT-TQ2403# get
  access-point      Guest, VLAN and VWN settings
  ap-list           AP list for rogue AP detection
  association       Associated station
  basic-rate        Basic rates of radios
  bridge-port       Bridge ports of bridge interfaces
  bss               Basic Service Set of radios
  channel-planner   Channel planner settings
  cluster           Clustering-based configuration settings
  config            Configuration settings
  detected-ap       Detected access point
  dhcp-client       DHCP client settings
  dot11             IEEE 802.11 (all radios)
  firmware-upgrade  Upgrade firmware of the AP through http
  host              Internet host settings
  interface         Network interface
  ip-route          IP route entry
  log               Log settings
  log-entry         Log entry
  mac-acl           MAC address access list item
  management        Management communication configurations
  ntp               Network Time Protocol client
  portal            Guest captive portal
  radio             Radio
  radius-user       RADIUS user
  serial            Serial access to the command line interface
  snmp              SNMP (Simple Network Management Protocol)
  ssh               SSH access to the command line interface
  static-ip-route   Static IP route entry - used when DHCP is off
  supported-rate    Supported rates of radios
  system            System settings
  telnet            Telnet access to the command line interface
  traphost          Destination host for SNMP trap
  tx-queue          Transmission queue parameters
  untagged-vlan     Untagged VLAN configuration
  vwn               Virtual Wireless Network
  web-server        Web server
  wme-queue         Transmission queue parameters for stations
```

- **Example 3:** Type "**get system v**" TAB. This will result in completion with the only matching property, "**get system version**". (Hit ENTER to get the output results of the command.)

```
AT-TQ2403# get system v
AT-TQ2403# get system version
```

- **Example 4:** Type "**set**" TAB TAB (including a space after set) to get a list of all property options for the set command.

```
AT-TQ2403#  set
```

access-point	Guest, VLAN and VWN settings
ap-list	AP list for rogue AP detection
bss	Basic Service Set of radios
channel-planner	Channel planner settings
cluster	Clustering-based configuration settings
config	Configuration settings
dhcp-client	DHCP client settings
dot11	IEEE 802.11 (all radios)
firmware-upgrade	Upgrade firmware of the AP through http
host	Internet host settings
interface	Network interface
log	Log settings
mac-acl	MAC address access list item
management	Management communication configurations
ntp	Network Time Protocol client
portal	Guest captive portal
radio	Radio
radius-user	RADIUS user
serial	Serial access to the command line interface
snmp	SNMP (Simple Network Management Protocol)
ssh	SSH access to the command line interface
static-ip-route	Static IP route entry - used when DHCP is off
system	System settings
telnet	Telnet access to the command line interface
traphost	Destination host for SNMP trap
tx-queue	Transmission queue parameters
untagged-vlan	Untagged VLAN configuration
vwn	Virtual Wireless Network
web-server	Web server
wme-queue	Transmission queue parameters for stations

- **Example 5:** Type "**set mac**" TAB, and the command will complete with the only matching option:

  AT-TQ2403# set mac-acl

- **Example 6:** Type "**set cluster**" TAB TAB, and the two matching options are displayed:

  AT-TQ2403# set cluster

cluster-name	Name of cluster to join
clustered	Whether clustering is enabled on this node
location	Location

- **Example 7:** Type "**add**" TAB TAB (including a space after add) to get a list of all property options for the add command.

  AT-TQ2403# add

ap-list	AP list for rogue AP detection
basic-rate	Basic rates of radios
bridge-port	Bridge ports of bridge interfaces
bss	Basic Service Set of radios
interface	Network interface
mac-acl	MAC address access list item
radius-user	RADIUS user
supported-rate	Supported rates of radios
traphost	Destination host for SNMP trap

- **Example 8:** Type "**remove**" TAB TAB (including a space after remove) to get a list of all property options for the remove command.

```
AT-TQ2403# remove
ap-list          AP list for rogue AP detection
basic-rate       Basic rates of radios
bridge-port      Bridge ports of bridge interfaces
bss              Basic Service Set of radios
interface        Network interface
mac-acl          MAC address access list item
radius-user      RADIUS user
supported-rate   Supported rates of radios
traphost         Destination host for SNMP trap
```

CLI Classes and Properties Reference

Configuration information for the AT-TQ2403 is represented as a set of classes and objects. The following is a general introduction to the CLI classes and properties. For a reference guide to all CLI classes and properties, see the CLI Class and Properties Reference documentation.

Different kinds of information uses different classes. For example, information about a network interface is represented by the "interface" class, while information about an NTP client is represented by the "ntp" class.

Depending on the type of class, there can be multiple instances of a class. For example, there is one instance of the "interface" class for each network interface the AP has (Ethernet, radio, and so on), while there is just a singleton instance of the "ntp" class, since an AP needs only a single NTP client. Some classes require their instances to have names to differentiate between them; these are called named classes. For example, one interface might have a name of eth0 to indicate that it is an Ethernet interface, while another interface could have a name of wlan0 to indicate it is a wireless LAN (WLAN) interface. Instances of singleton classes do not have names, since they only have a single instance. Classes that can have multiple instances but do not have a name are called anonymous classes. Together, singleton and anonymous classes are called unnamed classes. Some classes require their instances to have names, but the multiple instances can have the same name to indicate that they are part of the same group. These are called group classes.

has name? \ # of instances?	one	multiple
No	singleton	anonymous
yes – unique	n/a	unique named
yes - non-unique	n/a	group named

Each class defines a set of properties, that describe the actual information associated with a class. Each instance of a class will have a value for each property that contains the information. For example, the interface class has properties such as "ip" and "mask". For one instance, the ip property might have a value of 192.168.1.1 while the mask property has a value of 255.255.0.0; another instance might have an ip property with a value of 10.0.0.1 and mask property with a value of 255.0.0.0.

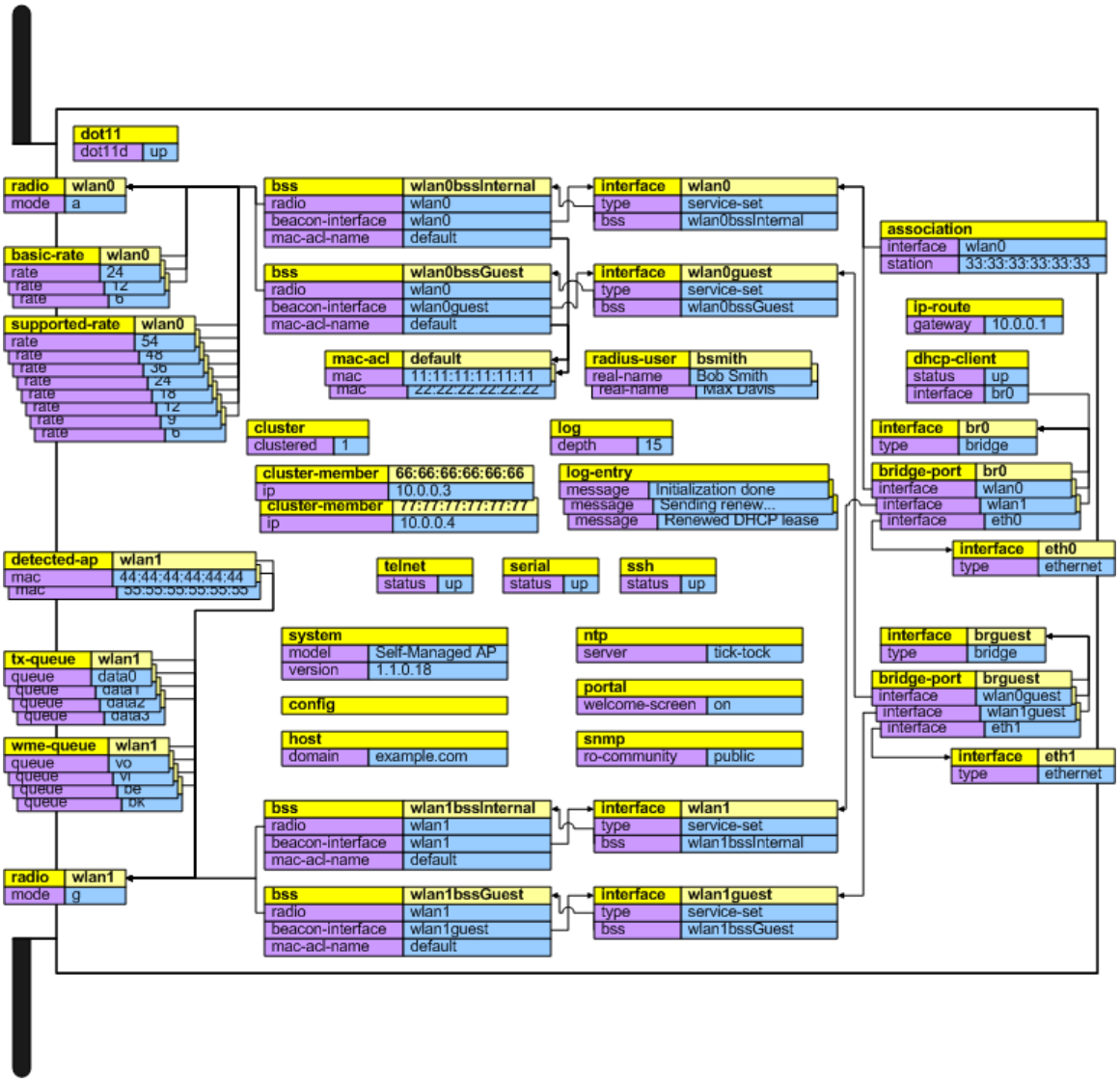


Figure 90: Kick Start Search Results Dialog Box

Glossary

0-9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

0-9

802

IEEE 802 (IEEE Std. 802-2001) is a family of standards for peer-to-peer communication over a LAN. These technologies use a shared-medium, with information broadcast for all stations to receive. The basic communications capabilities provided are packet-based. The basic unit of transmission is a sequence of data octets (8-bits), which can be of any length within a range that is dependent on the type of LAN.

Included in the 802 family of IEEE standards are definitions of bridging, management, and security protocols.

802.1x

IEEE 802.1x (IEEE Std. 802.1x-2001) is a standard for passing EAP packets over an 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). It establishes a framework that supports multiple authentication methods.

IEEE 802.1x authenticates users not machines.

802.2

IEEE 802.2 (IEEE Std. 802.2.1998) defines the LLC layer for the 802 family of standards.

802.3

IEEE 802.3 (IEEE Std. 802.3-2002) defines the MAC layer for networks that use CSMA/CA. Ethernet is an example of such a network.

802.11

IEEE 802.11 (IEEE Std. 802.11-1999) is a medium access control (MAC) and physical layer (PHY) specification for wireless connectivity for fixed, portable, and moving stations within a local area. It uses direct sequence spread spectrum (DSSS) in the 2.4 GHz ISM band and supports raw data rates of 1 and 2 Mbps. It was formally adopted in 1997 but has been mostly superseded by 802.11b.

IEEE 802.11 is also used generically to refer to the family of IEEE standards for wireless local area networks.

802.11a

IEEE 802.11a (IEEE Std. 802.11a-1999) is a PHY standard that specifies operating in the 5 GHz U-NII band using orthogonal frequency division multiplexing (OFDM). It supports data rates ranging from 6 to 54 Mbps.

802.11a Turbo

IEEE 802.11a Turbo is a proprietary variant of the 802.11a standard from Atheros Communications. It supports accelerated data rates ranging from 6 to 108Mbps. Atheros Turbo 5 GHz is IEEE 802.11a Turbo mode. Atheros Turbo 2.4 GHz is IEEE 802.11g Turbo mode.

802.11b

IEEE 802.11b (IEEE Std. 802.11b-1999) is an enhancement of the initial 802.11 PHY to include 5.5 Mbps and 11 Mbps data rates. It uses direct sequence spread spectrum (DSSS) or frequency hopping spread spectrum (FHSS) in the 2.4 GHz ISM band as well as complementary code keying (CCK) to provide the higher data rates. It supports data rates ranging from 1 to 11 Mbps.

802.11d

IEEE 802.11d defines standard rules for the operation of IEEE 802.11 wireless LANs in any country without reconfiguration. PHY requirements such as provides frequency hopping tables, acceptable channels, and power levels for each country are provided. Enabling support for IEEE 802.11d on the access point causes the AP to broadcast which country it is operating in as a part of its beacons. Client stations then use this information. This is particularly important for AP operation in the 5GHz IEEE 802.11a bands because use of these frequencies varies a great deal from one country to another.

802.11e

IEEE 802.11e is a developing IEEE standard for MAC enhancements to support QoS. It provides a mechanism to prioritize traffic within 802.11. It defines allowed changes in the Arbitration Interframe Space, a minimum and maximum Contention Window size, and the maximum length (in kμsec) of a burst of data.

IEEE 802.11e is still a draft IEEE standard (most recent version is D5.0, July 2003). A currently available subset of 802.11e is the Wireless Multimedia Enhancements (WMM) standard.

802.11f

IEEE 802.11f (IEEE Std. 802.11f-2003) is a standard that defines the inter access point protocol (IAPP) for access points (wireless hubs) in an extended service set (ESS). The standard defines how access points communicate the associations and reassociations of their mobile stations.

802.11g

IEEE 802.11g (IEEE Std. 802.11g-2003) is a higher speed extension (up to 54 Mbps) to the 802.11b PHY, while operating in the 2.4 GHz band. It uses orthogonal frequency division multiplexing (OFDM). It supports data rates ranging from 1 to 54 Mbps.

802.11h

IEEE 802.11h is a standard used is to resolve the issue of interference which was prevalent in 802.11a. The two schemes used to minimize interference in 802.11h are Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS). DFS detects other APs on the same frequency and redirects these to another channel. TCP reduces the network frequency output power of the AP, thus reducing the chance of any interference. This is a required standard in Europe, Japan, and the U.S.

802.11i

IEEE 802.11i is a comprehensive IEEE standard for security in a wireless local area network (WLAN) that describes Wi-Fi Protected Access 2 (WPA2). It defines enhancements to the MAC Layer to counter the some of the weaknesses of WEP. It incorporates stronger encryption techniques than the original Wi-Fi Protected Access (WPA), such as Advanced Encryption Standard (AES).

The original WPA, which can be considered a subset of 802.11i, uses Temporal Key Integrity Protocol (TKIP) for encryption. WPA2 is backwards-compatible with products that support the original WPA

IEEE 802.11i / WPA2 was finalized and ratified in June of 2004.

802.11j

IEEE 802.11j standardizes chipsets that can use both the 4.9 and 5 GHz radio bands according to rules specified by the Japanese government to open both bands to indoor, outdoor and mobile wireless LAN applications. The regulations require companies to adjust the width of those channels. IEEE 802.11j allows wireless devices to reach some previously unavailable channels by taking advantage of new frequencies and operating modes. This is partially an attempt to mitigate the crowding on the airwaves, and has tangential relationships to IEEE 802.11h.

802.11k

IEEE 802.11k is a developing IEEE standard for wireless networks (WLANs) that helps auto-manage network Channel selection, client Roaming, and Access Point (AP) utilization. 802.11k capable networks will automatically load balance network traffic across APs to improve network performance and prevent under or over-utilization of any one AP. 802.11k will eventually complement the 802.11e quality of service (QoS) standard by ensuring QoS for multimedia over a wireless link.

802.1p

802.1p is an extension of the IEEE 802 standard and is responsible for QoS provision. The primary purpose of 802.1p is to prioritize network traffic at the data link/ MAC layer. 802.1p offers the ability to filter multicast traffic to ensure it doesn't increase over layer 2 switched networks. It uses tag frames for the prioritization scheme.

To be compliant with this standard, layer 2 switches must be capable of grouping incoming LAN packets into separate traffic classes.

802.1Q

IEEE 802.1Q is the IEEE standard for Virtual Local Area Networks (VLANs) specific to wireless technologies. (See http://www.ieee802.org/1/pages/802.1Q.html.)

The standard addresses the problem of how to break large networks into smaller parts to prevent broadcast and multicast data traffic from consuming more bandwidth than is necessary. 802.11Q also provides for better security between segments of internal networks. The 802.1Q specification provides a standard method for inserting VLAN membership information into Ethernet frames.

A

Access Point

An access point is the communication hub for the devices on a WLAN, providing a connection or bridge between wireless and wired network devices. It supports a Wireless Networking Framework called Infrastructure Mode.

When one access point is connected to a wired network and supports a set of wireless stations, it is referred to as a basic service set (BSS). An extended service set (ESS) is created by combining two or more BSSs.

Ad hoc Mode

Ad hoc mode is a Wireless Networking Framework in which stations communicate directly with each other. It is useful for quickly establishing a network in situations where formal infrastructure is not required.

Ad hoc mode is also referred to as peer-to-peer mode or an independent basic service set (IBSS).

AES

The Advanced Encryption Standard (AES) is a symmetric 128-bit block data encryption technique developed to replace DES encryption. AES works at multiple network layers simultaneously.

Further information is available on the NIST Web site.

Atheros XR (Extended Range)

Atheros Extended Range (XR) is a proprietary method for implementing low rate traffic over longer distances. It is meant to be transparent to XR enabled clients and access points and is designed to interoperate with the 802.11 standard in 802.11g and 802.11a modes. There is no support for Atheros XR in 802.11b, Atheros Turbo 5 GHz, or Atheros Dynamic Turbo 5 GHz.

B

Basic Rate Set

The basic rate set defines the transmission rates that are mandatory for any station wanting to join this wireless network. All stations must be able to receive data at the rates listed in this set.

Beacon

Beacon frames provide the "heartbeat" of a WLAN, announcing the existence of the network, and enabling stations to establish and maintain communications in an orderly fashion. It carries the following information (some of which is optional):

- The Timestamp is used by stations to update their local clock, enabling synchronization among all associated stations.
- The Beacon interval defines the amount of time between transmitting beacon frames. Before entering power save mode, a station needs the beacon interval to know when to wake up to receive the beacon.
- The Capability Information lists requirements of stations that want to join the WLAN. For example, it indicates that all stations must use WEP.
- The Service Set Identifier (SSID).
- The Basic Rate Set is a bitmap that lists the rates that the WLAN supports.
- The optional Parameter Sets indicates features of the specific signaling methods in use (such as

frequency hopping spread spectrum, direct sequence spread spectrum, etc.).

- The optional Traffic Indication Map (TIM) identifies stations, using power saving mode, that have data frames queued for them.

Bridge

A connection between two local area networks (LANs) using the same protocol, such as Ethernet or IEEE 802.1x.

Broadcast

A Broadcast sends the same message at the same time to everyone. In wireless networks, broadcast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 802.1x Frames to all client stations on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Unicast and Multicast.

Broadcast Address

See IP Address.

BSS

A basic service set (BSS) is an Infrastructure Mode Wireless Networking Framework with a single access point. Also see extended service set (ESS) and independent basic service set (IBSS).

BSSID

In Infrastructure Mode, the Basic Service Set Identifier (BSSID) is the 48-bit MAC address of the wireless interface of the Access Point.

C

CCMP

Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for 802.11i that uses AES. It employs a CCM mode of operation, combining the Cipher Block Chaining Counter mode (CBC-CTR) and the Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity.

AES-CCMP requires a hardware coprocessor to operate.

CGI

The Common Gateway Interface (CGI) is a standard for running external programs from an HTTP server. It specifies how to pass arguments to the executing program as part of the HTTP request. It may also define a set of environment variables.

A CGI program is a common way for an HTTP server to interact dynamically with users. For example, an HTML page containing a form can use a CGI program to process the form data after it is submitted.

Channel

The Channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each 802.11 standard offers a number of channels, dependent on how the spectrum is licensed by national and

transnational authorities such as the Federal Communications Commission (FCC), the European Telecommunications Standards Institute (ETSI), the Korean Communications Commission, or the Telecom Engineering Center (TELEC).

CSMA/CA

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) is a low-level network arbitration/ contention protocol. A station listens to the media and attempts to transmit a packet when the channel is quiet. When it detects that the channel is idle, the station transmits the packet. If it detects that the channel is busy, the station waits a random amount of time and then attempts to access the media again.

CSMA/CA is the basis of the IEEE 802.11e Distributed Control Function (DCF). See also RTS and CTS.

The CSMA/CA protocol used by 802.11 networks is a variation on CSMA/CD (used by Ethernet networks). In CSMA/CD the emphasis is on collision detection whereas with CSMA/CA the emphasis is on collision avoidance.

CTS

A clear to send (CTS) message is a signal sent by an IEEE 802.11 client station in response to a request to send (RTS) message. The CTS message indicates that the channel is clear for the sender of the RTS message to begin data transfer. The other stations will wait to keep the air waves clear. This message is a part of the IEEE 802.11 CSMA/CA protocol. (See also RTS.)

D

DCF

The Distribution Control Function is a component of the IEEE 802.11e Quality of Service (QoS) technology standard. The DCF coordinates channel access among multiple stations on a wireless network by controlling wait times for channel access. Wait times are determined by a random backoff timer which is configurable by defining minimum and maximum contention windows. See also EDCA.

DHCP

The Dynamic Host Configuration Protocol (DHCP) is a protocol specifying how a central server can dynamically provide network configuration information to clients. A DHCP server "offers" a "lease" (for a pre-configured period of time—see Lease Time) to the client system. The information supplied includes the client's IP addresses and netmask plus the address of its DNS servers and Gateway.

DNS

The Domain Name Service (DNS) is a general-purpose query service used for translating fully-qualified names into Internet addresses. A fully-qualified name consists of the hostname of a system plus its domain name. For example, www is the host name of a Web server and www.alliedtelesis.com is the fully-qualified name of that server. DNS translates the domain name www.alliedtelesis.com to some IP address, for example 66.93.138.219.

A domain name identifies one or more IP addresses. Conversely, an IP address may map to more than one domain name.

A domain name has a suffix that indicates which top level domain (TLD) it belongs to. Every country has its own top-level domain, for example .de for Germany, .fr for France, .jp for Japan, .tw for Taiwan, .uk for the United Kingdom, .us for the U.S.A., and so on. There are also .com for commercial bodies, .edu for educational institutions, .net for network operators, and .org for other organizations as well as .gov for the U. S. government and .mil for its armed services.

DOM

The Document Object Model (DOM) is an interface that allows programs and scripts to dynamically access and update the content, structure, and style of documents. The DOM allows you to model the objects in an HTML or XML document (text, links, images, tables), defining the attributes of each object and how they can be manipulated.

Further details about the DOM can be found at the W3C.

DTIM

All Beacon frames include a Traffic Information Map information element (TIM IE). In some beacon frames, the TIM IE includes a Delivery Traffic Information Map (DTIM) message. These special DTIM beacons are sent at an interval specified in the DTIM period. Another way of expressing this is:

Every xth TIM IE is DTIM (where X = DTIM Period)

The DTIM beacon alerts the clients that multicast and broadcast packets buffered at the AP will be transmitted immediately after the transmission of this beacon frame.

Dynamic IP Address

See IP Address.

E

EAP

The Extensible Authentication Protocol (EAP) is an authentication protocol that supports multiple methods, such as token cards, Kerberos, one-time passwords, certificates, public key authentication, and smart cards.

Variations on EAP include EAP Cisco Wireless (LEAP), Protected EAP (PEAP), EAP-TLS, and EAP Tunnelled TLS (EAP-TTLS).

EDCA

Enhanced Distributed Channel Access is an extension of DCF. EDCA, a component of the IEEE Wireless Multimedia (WMM) standard, provides prioritized access to the wireless medium.

ESS

An Extended Service Set (ESS) is an Infrastructure Mode Wireless Networking Framework with multiple access points, forming a single subnetwork that can support more clients than a basic service set (BSS). Each access point supports a number of wireless stations, providing broader wireless coverage for a large space, for example, an office.

Ethernet

thernet is a local-area network (LAN) architecture supporting data transfer rates of 10 Mbps to 1 Gbps. The Ethernet specification is the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. It uses the CSMA/CA access method to handle simultaneous demands.

Ethernet supports data rates of 10 Mbps, Fast Ethernet supports 100 Mbps, and Gigabit Ethernet supports 1 Gbps. Its cables are classified as "XbaseY", where X is the data rate in Mbps and Y is the category of cabling. The original cable was 10base5 (Thicknet or "Yellow Cable"). Some others are 10base2 (Cheapernet), 10baseT (Twisted Pair), and 100baseT (Fast Ethernet). The latter two are commonly supplied using CAT5 cabling with RJ-45 connectors. There is also 1000baseT (Gigabit Ethernet).

ERP

The Extended Rate Protocol refers to the protocol used by IEEE 802.11g stations (over 20 Mbps transmission rates at 2.4GHz) when paired with Orthogonal Frequency Division Multiplexing (OFDM). Built into ERP and the IEEE 802.11g standard is a scheme for effective interoperability of IEEE 802.11g stations with IEEE 802.11b nodes on the same channel.

Legacy IEEE 802.11b devices cannot detect the ERP-OFDM signals used by IEEE 802.11g stations, and this can result in collisions between data frames from IEEE 802.11b and IEEE 802.11g stations.

If there is a mix of 802.11b and 802.11g nodes on the same channel, the IEEE 802.11g stations detect this via an ERP flag on the access point and enable request to send (RTS) and clear to send (CTS) protection before sending data.

See also CSMA/CA protocol.

F

Frame

A Frame consists of a discrete portion of data along with some descriptive meta-information packaged for transmission on a wireless network. Each frame includes a source and destination MAC address, a control field with protocol version, frame type, frame sequence number, frame body (with the actual information to be transmitted) and frame check sequence for error detection. A Frame is similar in concept to a Packet, the difference being that a packet operates on the Network layer (layer 3 in the OSI model) whereas a frame operates on the Data-Link layer (layer 2 in the OSI model).

G

Gateway

A gateway is a network node that serves as an entrance to another network. A gateway also often provides a proxy server and a firewall. It is associated with both a router, which use headers and forwarding tables to determine where packets are sent, and a switch or bridge, which provides the actual path for the packet in and out of the gateway.

Before a host on a LAN can access the Internet, it needs to know the address of its default gateway.

H

HTML

The Hypertext Markup Language (HTML) defines the structure of a document on the World Wide Web. It uses tags and attributes to hint about a layout for the document.

An HTML document starts with an <html> tag and ends with a </html> tag. A properly formatted document also contains a <head> ... </head> section, which contains the metadata to define the document, and a <body> ... </body> section, which contains its content. Its markup is derived from the Standard Generalized Markup Language (SGML).

HTML documents are sent from server to browser via HTTP. Also see XML.

HTTP

The Hypertext Transfer Protocol (HTTP) defines how messages are formatted and transmitted on the World Wide Web. An HTTP message consists of a URL and a command (GET, HEAD, POST, etc.), a request followed by a response.

HTTPS

The Secure Hypertext Transfer Protocol (HTTPS) is the secure version of HTTP, the communication protocol of the World Wide Web. HTTPS is built into the browser. If you are using HTTPS you will notice a closed lock icon at the bottom corner of your browser page.

All data sent via HTTPS is encrypted, thus ensuring secure transactions take place.

I

IAPP

The Inter Access Point Protocol (IAPP) is an IEEE standard (802.11f) that defines communication between the access points in a "distribution system". This includes the exchange of information about mobile stations and the maintenance of bridge forwarding tables, plus securing the communications between access points.

IBSS

An independent basic service set (IBSS) is an Ad hoc Mode Wireless Networking Framework in which stations communicate directly with each other.

IEEE

The Institute of Electrical and Electronic Engineers (IEEE) is an international standards body that develops and establishes industry standards for a broad range of technologies, including the 802 family of networking and wireless standards. (See 802, 802.1x, 802.11, 802.11a, 802.11b, 802.11e, 802.11f, 802.11g, and 802.11i.)

For more information about IEEE task groups and standards, see http://standards.ieee.org/.

Infrastructure Mode

Infrastructure Mode is a Wireless Networking Framework in which wireless stations communicate with each other by first going through an Access Point. In this mode, the wireless stations can communicate with each other or can communicate with hosts on a wired network. The access point is connected to a wired network and supports a set of wireless stations.

An infrastructure mode framework can be provided by a single access point (BSS) or a number of access points (ESS).

Intrusion Detection

The Intrusion Detection System (IDS) inspects all inbound network activity and reports suspicious patterns that may indicate a network or system attack from someone attempting to break into the system. It reports access attempts using unsupported or known insecure protocols.

IP

The Internet Protocol (IP) specifies the format of packets, also called datagrams, and the addressing scheme. IP is a connectionless, best-effort packet switching protocol. It provides packet routing, fragmentation and re-assembly. It is combined with higher-level protocols, such as TCP or UDP, to establish the virtual connection between destination and source.

The current version of IP is IPv4. A new version, called IPv6 or IPng, is under development. IPv6 is an attempt to solve the shortage of IP addresses.

IP Address

Systems are defined by their IP address, a four-byte (octet) number uniquely defining each host on the Internet. It is usually shown in form 192.168.2.254. This is called dotted-decimal notation.

An IP address is partitioned into two portions: the network prefix and a host number on that network. A Subnet Mask is used to define the portions. There are two special host numbers:

- The Network Address consists of a host number that is all zeroes (for example, 192.168.2.0).
- The Broadcast Address consists of a host number that is all ones (for example, 192.168.2.255).

There are a finite number of IP addresses that can exist. Therefore, a local area network typically uses one of the IANA-designated address ranges for use in private networks. These address ranges are:

10.0.0.0 to 10.255.255.255
172.16.0.0 to 172.31.255.255
192.168.0.0 to 192.168.255.255

A Dynamic IP Address is an IP address that is automatically assigned to a host by a DHCP server or similar mechanism. It is called dynamic because you may be assigned a different IP address each time you establish a connection.

A Static IP Address is an IP address that is hard-wired for a specific host. A static address is usually required for any host that is running a server, for example, a Web server.

IPSec

IP Security (IPSec) is a set of protocols to support the secure exchange of packets at the IP layer. It uses shared public keys. There are two encryption modes: Transport and Tunnel.

- Transport mode encrypts only the data portion (payload) of each packet, but leaves the headers untouched.
- The more secure Tunnel mode encrypts both the header and the payload.

ISP

An Internet Service Provider (ISP) is a company that provides access to the Internet to individuals and companies. It may provide related services such as virtual hosting, network consulting, Web design, etc.

J

Jitter

Jitter is the difference between the latency (or delay) in packet transmission from one node to another across a network. If packets are not transmitted at a consistent rate (including Latency), QoS for some types of data can be affected. For example, inconsistent transmission rates can cause distortion in VoIP and streaming media. QoS is designed to reduce jitter along with other factors that can impact network performance.

L

Latency

Latency, also known as delay, is the amount of time it takes to transmit a Packet from sender to receiver. Latency can occur when data is transmitted from the access point to a client and vice versa. It can also occur when data is transmitted from access point to the Internet and vice versa. Latency is caused by fixed network factors such as the time it takes to encode and decode a packet, and also by variable network factors such as a busy or overloaded network. QoS features are designed to minimize latency for high priority network traffic.

LAN

A Local Area Network (LAN) is a communications network covering a limited area, for example, the computers in your home that you want to network together or a couple of floors in a building. A LAN connects multiple computers and other network devices such as storage and printers. Ethernet is the most common technology implementing a LAN.

Wireless Ethernet (802.11) is another very popular LAN technology (also see WLAN).

LDAP

The Lightweight Directory Access Protocol (LDAP) is a protocol for accessing on-line directory services. It is used to provide an authentication mechanism. It is based on the X.500 standard, but less complex.

Lease Time

The Lease Time specifies the period of time the DHCP Server gives its clients an IP Address and other required information. When the lease expires, the client must request a new lease. If the lease is set to a short span, you can update your network information and propagate the information provided to the clients in a timely manner.

LLC

The Logical Link Control (LLC) layer controls frame synchronization, flow control, and error checking. It is a higher level protocol over the PHY layer, working in conjunction with the MAC layer.

M

MAC

The Media Access Control (MAC) layer handles moving data packets between NICs across a shared channel. It is a higher level protocol over the PHY layer. It provides an arbitration mechanism in an attempt to prevent signals from colliding.

It uses a hardware address, known as the MAC address, that uniquely identifies each node of a network. IEEE 802 network devices share a common 48-bit MAC address format, displayed as a string of twelve (12) hexadecimal digits separated by colons, for example FE:DC:BA:09:87:65.

MDI and MDI-X

Medium Dependent Interface (MDI) and MDI crossover (MDIX) are twisted pair cabling technologies for Ethernet ports in hardware devices. Built-in twisted pair cabling and auto-sensing enable connection between like devices with the use of a standard Ethernet cable. (For example, if a wireless access point supports MDI/MDIX, one can successfully connect a PC and that access point with an Ethernet cable rather than having to use a crossover cable).

MIB

Management Information Base (MIB) is a virtual database of objects used for network management. SNMP agents along with other SNMP tools can be used to monitor any network device defined in the MIB.

MSCHAP V2

Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAP V2) provides authentication for PPP connections between a Windows-based computer and an Access Point or other network access device.

MTU

The Maximum Transmission Unit is the largest physical packet size, measured in bytes, that a network can transmit. Any messages larger than the MTU are fragmented into smaller packets before being sent.

Multicast

A Multicast sends the same message to a select group of recipients. Sending an e-mail message to a mailing list is an example of multicasting. In wireless networks, multicast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 802.1x Frames to a specified set of client stations (MAC addresses) on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Unicast and Broadcast.

N

NAT

Network Address Translation is an Internet standard that masks the internal IP addresses being used in a LAN. A NAT server running on a gateway maintains a translation table that maps all internal IP addresses in outbound requests to its own address and converts all inbound requests to the correct internal host.

NAT serves three main purposes: it provides security by obscurity by hiding internal IP addresses, enables the use of a wide range of internal IP addresses without fear of conflict with the addresses used by other organizations, and it allows the use of a single Internet connection.

Network Address

See IP Address.

NIC

A Network Interface Card is an adapter or expansion board inserted into a computer to provide a physical connection to a network. Most NICs are designed for a particular type of network, protocol, and media, for example, Ethernet or wireless.

NTP

The Network Time Protocol assures accurate synchronization of the system clocks in a network of computers. NTP servers transmit Coordinated Universal Time (UTC, also known as Greenwich Mean Time) to their client systems. An NTP client sends periodic time requests to servers, using the returned time stamp to adjust its clock.

O

OSI

The Open Systems Interconnection (OSI) reference model is a framework for network design. The OSI model consists of seven layers:

- Layer 1, the Physical layer, identifies the physical medium used for communication between nodes. In the case of wireless networks, the physical medium is air, and radio frequency (RF) waves are components of the physical layer.
- Layer 2, the Data-Link layer, defines how data for transmission will be structured and formatted, along

with low-level protocols for communication and addressing. For example, protocols such as CSMA/CA and components like MAC addresses, and Frames are all defined and dealt with as a part of the Data-Link layer.

- Layer 3, the Network layer, defines the how to determine the best path for information traversing the network. Packets and logical IP Addresses operate on the network layer.
- Layer 4, the Transport layer, defines connection oriented protocols such as TCP and UDP.
- Layer 5, the Session layer, defines protocols for initiating, maintaining, and ending communication and transactions across the network. Some common examples of protocols that operate on this layer are network file system (NFS) and structured query language (SQL). Also part of this layer are communication flows like single mode (device sends information bulk), half-duplex mode (devices take turns transmitting information in bulk), and full-duplex mode (interactive, where devices transmit and receive simultaneously).
- Layer 6, the Presentation layer, defines how information is presented to the application. It includes meta-information about how to encrypt/decrypt and compress/decompress the data. JPEG and TIFF file formats are examples of protocols at this layer.
- Layer 7, the Application layer, includes protocols like hypertext transfer protocol (HTTP), simple mail transfer protocol (SMTP), and file transfer protocol (FTP).

P

Packet

Data and media are transmitted among nodes on a network in the form of packets. Data and multimedia content is divided up and packaged into packets. A packet includes a small chunk of the content to be sent along with its destination address and sender address. Packets are pushed out onto the network and inspected by each node. The node to which it is addressed is the ultimate recipient.

Packet Loss

Packet Loss describes the percentage of packets transmitted over the network that did not reach their intended destination. A 0 percent package loss indicates no packets were lost in transmission. QoS features are designed to minimize packet loss.

PHY

The Physical Layer (PHY) is the lowest layer in the network layer model (see OSI). The Physical Layer conveys the bit stream - electrical impulse, light or radio signal -- through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a medium, including defining cables, NICs, and physical aspects.

Ethernet and the 802.11 family are protocols with physical layer components.

PID

The Process Identifier (PID) is an integer used by Linux to uniquely identify a process. A PID is returned by the fork() system call. It can be used by wait() or kill() to perform actions on the given process.

Port Forwarding

Port Forwarding creates a ‘tunnel’ through a firewall, allowing users on the Internet access to a service running on one of the computers on your LAN, for example, a Web server, an FTP or SSH server, or other services. From the outside user’s point of view, it looks like the service is running on the firewall.

PPP

The Point-to-Point Protocol is a standard for transmitting network layer datagrams (IP packets) over serial point-to-point links. PPP is designed to operate both over asynchronous connections and bit-oriented synchronous systems.

PPPoE

Point-to-Point Protocol over Ethernet (PPPoE) is a specification for connecting the users on a LAN to the Internet through a common broadband medium, such as a single DSL or cable modem line.

PPtP

Point-to-Point Tunneling Protocol (PPtP) is a technology for creating a Virtual Private Network (VPN) within the Point-to-Point Protocol (PPP). It is used to ensure that data transmitted from one VPN node to another are secure.

Proxy

A proxy is server located between a client application and a real server. It intercepts requests, attempting to fulfill them itself. If it cannot, it forwards them to the real server. Proxy servers have two main purposes: improve performance by spreading requests over several machines and filter requests to prevent access to specific servers or services.

PSK

Pre-Shared Key (PSK), see Shared Key.

Public Key

A public key is used in public key cryptography to encrypt a message which can only be decrypted with the recipient's private or secret key. Public key encryption is also called asymmetric encryption, because it uses two keys, or Diffie-Hellman encryption. Also see Shared Key.

Q

QoS

Quality of Service (QoS) defines the performance properties of a network service, including guaranteed throughput, transit delay, and priority queues. QoS is designed to minimize Latency, Jitter, Packet Loss, and network congestion, and provide a way of allocating dedicated bandwidth for high priority network traffic.

The IEEE standard for implementing QoS on wireless networks is currently in-work by the 802.11e task group. A subset of 802.11e features is described in the WMM specification.

R

RADIUS

The Remote Authentication Dial-In User Service (RADIUS) provides an authentication and accounting system. It is a popular authentication mechanism for many ISPs.

RC4

A symmetric stream cipher provided by RSA Security. It is a variable key-size stream cipher with byte-oriented operations. It allows keys up to 2048 bits in length.

Roaming

In IEEE 802.11 parlance, roaming clients are mobile client stations or devices on a wireless network (WLAN) that require use of more than one Access Point (AP) as they move out of and into range of different base station service areas. IEEE 802.11f defines a standard by which APs can communicate information about client associations and disassociations in support of roaming clients.

Router

A router is a network device which forwards packets between networks. It is connected to at least two networks, commonly between two local area networks (LANs) or between a LAN and a wide-area network (WAN), for example, the Internet. Routers are located at gateways—places where two or more networks connect.

A router uses the content of headers and its tables to determine the best path for forwarding a packet. It uses protocols such as the Internet Control Message Protocol (ICMP), Routing Information Protocol (RIP), and Internet Router Discovery Protocol (IRDP) to communicate with other routers to configure the best route between any two hosts. The router performs little filtering of data it passes.

RSSI

The Received Signal Strength Indication (RSSI) an 802.1x value that calculates voltage relative to the received signal strength. RSSI is one of several ways of measuring and indicating radio frequency (RF) signal strength. Signal strength can also be measured in mW (milliwatts), dBms (decibel milliwatts), and a percentage value.

RTP

Real-Time Transport Protocol (RTP) is an Internet protocol for transmitting real-time data like audio and video. It does not guarantee delivery but provides support mechanisms for the sending and receiving applications to enable streaming data. RTP typically runs on top of the UDP protocol, but can support other transport protocols as well.

RTS

A request to send (RTS) message is a signal sent by a client station to the access point, asking permission to send a data packet and to prevent other wireless client stations from grabbing the radio waves. This message is a part of the IEEE 802.11 CSMA/CA protocol. (See also RTS Threshold and CTS.)

RTS Threshold

The RTS threshold specifies the packet size at which packet transmission is governed by the RTS/CTS transaction.

S

Shared Key

A shared key is used in conventional encryption where one key is used both for encryption and decryption. It is also called secret-key or symmetric-key encryption.

Also see Public Key.

SNMP

The Simple Network Management Protocol (SNMP) was developed to manage and monitor nodes on a network. It is part of the TCP/IP protocol suite.

SNMP consists of managed devices and their agents, and a management system. The agents store data about their devices in Management Information Bases (MIBs) and return this data to the SNMP management system when requested.

SNMP Traps

SNMP traps enable the asynchronous communication from network devices to managed agents. Setting SNMP traps saves on network resources and eliminates redundant SNMP requests.

SSID

The Service Set Identifier (SSID) is a thirty-two character key that uniquely identifies a wireless local area network. It is also referred to as the Network Name. There are no restrictions on the characters that may be used in an SSID.

Static IP Address

See IP Address.

STP

The Spanning Tree Protocol (STP) is an IEEE 802.1 standard protocol (related to network management) for MAC bridges that manages path redundancy and prevents undesirable loops in the network created by multiple active paths between client stations. Loops occur when there are multiple routes between access points. STP creates a tree that spans all of the switches in an extended network, forcing redundant paths into a standby or blocked state. STP allows only one active path at a time between any two network devices (this prevents the loops), but establishes the redundant links as a backup if the initial link should fail. If STP costs change, or if one network segment in the STP becomes unreachable, the spanning tree algorithm reconfigures the spanning tree topology and reestablishes the link by activating the standby path. Without STP in place, it is possible that both connections may be simultaneously live, which could result in an endless loop of traffic on the LAN.

Subnet Mask

A Subnet Mask is a number that defines which part of an IP address is the network address and which part is a host address on the network. It is shown in dotted-decimal notation (for example, a 24-bit mask is shown as 255.255.255.0) or as a number appended to the IP address (for example, 192.168.2.0/24).

The subnet mask allows a router to quickly determine if an IP address is local or needs to be forwarded by performing a bitwise AND operation on the mask and the IP address. For example, if an IP address is 192.168.2.128 and the netmask is 255.255.255.0, the resulting Network address is 192.168.2.0.

The bitwise AND operator compares two bits and assigns 1 to the result only if both bits are 1. The following table shows the details of the netmask:

IP address	192.168.2.128	11000000	10101000	00000010	10000000
Netmask	255.255.255.0	11111111	11111111	11111111	00000000
Resulting network address	192.168.2.0	11000000	10101000	00000010	00000000

Supported Rate Set

The supported rate set defines the transmission rates that are available on this wireless network. A station may be able to receive data at any of the rates listed in this set. All stations must be able to receive data at the rates listed in the Basic Rate Set.

SVP

SpectraLink Voice Priority (SVP) is a QoS approach to Wi-Fi deployments. SVP is an open specification that is compliant with the IEEE 802.11b standard. SVP minimizes delay and prioritizes voice packets over data packets on the Wireless LAN, thus increasing the probability of better network performance.

T

TCP

The Transmission Control Protocol (TCP) is built on top of Internet Protocol (IP). It adds reliable communication (guarantees delivery of data), flow-control, multiplexing (more than one simultaneous connection), and connection-oriented transmission (requires the receiver of a packet to acknowledge receipt to the sender). It also guarantees that packets will be delivered in the same order in which they were sent.

TCP/IP

The Internet and most local area networks are defined by a group of protocols. The most important of these is the Transmission Control Protocol over Internet Protocol (TCP/IP), the de facto standard protocols. TCP/IP was originally developed by Defense Advanced Research Projects Agency (DARPA, also known as ARPA, an agency of the US Department of Defense).

Although TCP and IP are two specific protocols, TCP/IP is often used to refer to the entire protocol suite based upon these, including ICMP, ARP, UDP, and others, as well as applications that run upon these protocols, such as telnet, FTP, etc.

TKIP

The Temporal Key Integrity Protocol (TKIP) provides an extended 48-bit initialization vector, per-packet key construction and distribution, a Message Integrity Code (MIC, sometimes called "Michael"), and a re-keying mechanism. It uses a RC4 stream cipher to encrypt the frame body and CRC of each 802.11 frame before transmission. It is an important component of the WPA and 802.11i security mechanisms.

U

UDP

The User Datagram Protocol (UDP) is a transport layer protocol providing simple but unreliable datagram services. It adds port address information and a checksum to an IP packet.

UDP neither guarantees delivery nor does it require a connection. It is lightweight and efficient. All error processing and retransmission must be performed by the application program.

Unicast

A Unicast sends a message to a single, specified receiver. In wireless networks, unicast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 802.1x Frames directly to a single client station MAC address on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Multicast and Broadcast.

URL

A Uniform Resource Locator (URL) is a standard for specifying the location of objects on the Internet, such as a file or a newsgroup. URLs are used extensively in HTML documents to specify the target of a hyperlink which is often another HTML document (possibly stored on another computer). The first part of the URL indicates what protocol to use and the second part specifies the IP address or the domain name where that resource is located.

V

VLAN

A virtual LAN (VLAN) is a software-based, logical grouping of devices on a network that allow them to act as if they are connected to a single physical network, even though they may not be. The nodes in a VLAN share resources and bandwidth, and are isolated on that network. The AT-TQ2403 Wireless AP supports the configuration of a wireless VLAN. This technology is leveraged on the access point for the "virtual" guest network feature.

VPN

A Virtual Private Network (VPN) is a network that uses the Internet to connect its nodes. It uses encryption and other mechanisms to ensure that only authorized users can access its nodes and that data cannot be intercepted.

W

WAN

A Wide Area Network (WAN) is a communications network that spans a relatively large geographical area, extending over distances greater than one kilometer. A WAN is often connected through public networks, such as the telephone system. It can also be connected through leased lines or satellites.

The Internet is essentially a very large WAN.

WDS

A Wireless Distribution System (WDS) allows the creation of a completely wireless infrastructure. Typically, an Access Point is connected to a wired LAN. WDS allows access points to be connected wirelessly. The access points can function as wireless repeaters or bridges.

WEP

Wired Equivalent Privacy (WEP) is a data encryption protocol for 802.11 wireless networks. All wireless stations and access points on the network are configured with a static 64-bit (40-bit secret key + 24-bit initialization vector (IV)) or 128-bit (104-bit secret key + 24-bit IV) Shared Key for data encryption. It uses a RC4 stream cipher to encrypt the frame body and CRC of each 802.11 frame before transmission.

Wi-Fi

A test and certification of interoperability for WLAN products based on the IEEE 802.11 standard promoted by the Wi-Fi Alliance, a non-profit trade organization.

WINS

The Windows Internet Naming Service (WINS) is a server process for resolving Windows-based computer names to IP addresses. It provides information that allows these systems to browse remote networks using the Network Neighborhood.

Wireless Networking Framework

There are two ways of organizing a wireless network:

- Stations communicate directly with one another in an Ad hoc Mode network, also known as an independent basic service set (IBSS).

- Stations communicate through an Access Point in an Infrastructure Mode network. A single access point creates an infrastructure basic service set (BSS) whereas multiple access points are organized in an extended service set (ESS).

WLAN

Wireless Local Area Network (WLAN) is a LAN that uses high-frequency radio waves rather than wires to communicate between its nodes.

WMM

Wireless Multimedia (WMM) is an IEEE technology standard designed to improve the quality of audio, video and multimedia applications on a wireless network. Both access points and wireless clients (laptops, consumer electronics products) can be WMM-enabled. WMM features are based on is a subset of the WLAN IEEE 802.11e draft specification. Wireless products that are built to the standard and pass a set of quality tests can carry the "Wi-Fi certified for WMM" label to ensure interoperability with other such products. For more information, see the WMM page on the Wi-Fi Alliance Web site: http://www.wi-fi.org/OpenSection/wmm.asp.

WPA

Wi-Fi Protected Access (WPA) is a Wi-Fi Alliance version of the draft IEEE 802.11i standard. It provides more sophisticated data encryption than WEP and also provides user authentication. WPA includes TKIP and 802.1x mechanisms.

WPA2

WiFi Protected Access (WPA2) is an enhanced security standard, described in IEEE 802.11i, that uses Advanced Encryption Standard (AES) for data encryption.

The original WPA uses Temporal Key Integrity Protocol (TKIP) for data encyrption. WPA2 is backwards-compatible with products that support the original WPA.

WPA2, like the original WPA, supports an Enterprise and Personal version. The Enterprise version requires use of IEEE 802.1x security features and Extensible Authentication Protocol (EAP) authentication with a RADIUS server.

The Personal version does not require IEEE 802.1x or EAP. It uses a Pre-Shared Key (PSK) password to generate the keys needed for authentication.

WRAP

Wireless Robust Authentication Protocol (WRAP) is an encryption method for 802.11i that uses AES but another encryption mode (OCB) for encryption and integrity.

X

XML

The Extensible Markup Language (XML) is a specification developed by the W3C. XML is a simple, flexible text format derived from Standard Generalized Markup Language (SGML) designed especially for electronic publishing.